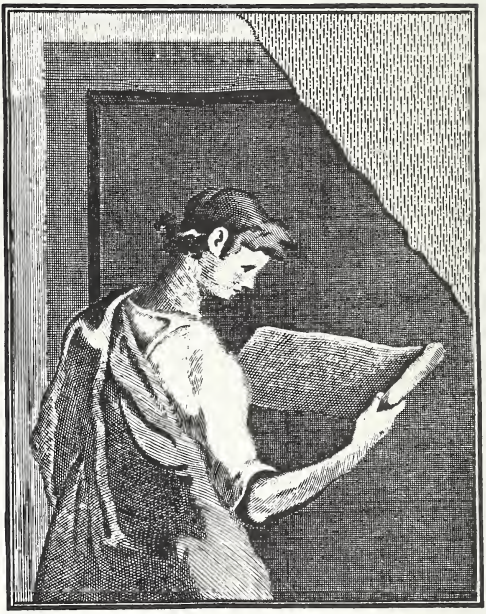

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THE

DYER'S GUIDE,

&c. &c.

BARNARD AND FARLEY,
Skinner-Street, London.

THE

DYER'S GUIDE;

BEING AN

INTRODUCTION

TO THE

ART OF DYING

LINEN,
COTTON,
SILK, AND

WOOL,
SILK AND
MUSLIN

DRESSES,
FURNITURE,
&c. &c.

WITH

DIRECTIONS FOR CALENDERING, GLAZING,

AND

FRAMING THE VARIOUS SPECIES;

THE MODE OF SCOURING WOOL, BLEACHING COTTON, &c.

MANNER OF UNGUMMING SILK, AND OF WHITENING AND SULPHURING SILK AND WOOL:

WITH AN

APPENDIX OF OBSERVATIONS,
CHEMICAL AND EXPLANATORY,

ESSENTIAL TO THE PROPER AND SCIENTIFIC KNOWLEDGE OF THE ART, ACCORDING TO THE MODERN PRACTICE.

CONS.
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897
P11
1816

BY THOMAS PACKER,
DYER.

> "There is no art which depends so much on chemistry as dying, yet its principles are by no means established; neither are the facts connected by a satisfactory theory: but, as chemists are now become dyers, and dyers chemists, we may hope that this art will soon assume a more scientific form."—*Vide Garnett's Chemical Outlines.*

LONDON:
PRINTED FOR SHERWOOD, NEELY, AND JONES,
PATERNOSTER-ROW.

1816.

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Introduction.

THE use and importance of the present little Work, is most undoubtedly enhanced by the fact, that no Treatise is to be found in the English language on the ART OF DYING, since the gases have been discovered. All that has been written by Hellot, Macquer, D'Apligny, &c. was upon the old exploded principles of phlogiston.

The writings, of Bertholet, who was a *Chemist*, but not a *Dyer*, form some exception to this charge; but he is known, nevertheless, to have borrowed his processes in dying from Hellot and Macquer: and Bancroft is too expensive and voluminous for an introductory work.

I readily admit that Hellot and Macquer have been of considerable service to the art; but they could not communicate any information, excepting from the theory existing in their time. I have borrowed all that is essential, in them, abbreviating, altering, and giving additions, according to the present improved state of chemistry, as far as was possible, within the limits prescribed for this work, for it to be within the reach and possession of the most numerous class of dyers; that is, journeymen and apprentices, in all the various branches of this truly extensive and mysterious art, as carried on in London, Norwich, Yorkshire, Gloucestershire, and various other parts of the British dominions.

I have attended to no other arrangement than nearly following that of the title, taking cotton first, because of its having the least and fewest affinities for other bodies. Silk I have taken next into consideration, so far as its processes are similar to cotton, though silk has greater affinity to resinous substances, receiving a more beautiful dye from annatto, safflower, archil, &c. than cotton, and more permanent.

Wool, I have not entirely placed last, although many of the colours, which it receives from the hand of the dyer, are complex. The cotton and silk, black dying are arranged with, or after the processes of black for wool, as likewise the Turkey red, &c. as being naturally difficult to perform.

The improved practice of the present time, has done away with great and little dye, a distinction kept up by the French.

In consequence of the fashions changing more or less monthly, silk and wool especially, will retain the most beautiful colours of pink, lilac, peach, &c. the period of the fashion, and longer, when done in the most scientific manner, and by principles which chemistry directs, and as here laid down.

What is borrowed from others I have acknowledged; wherein I differ, or add, I have mostly pointed out.

Chemical terms, names, &c. now introduced in dying, are chiefly taken from the Greek language, in such a manner as to make their etymology convey some idea of what is meant to be represented. Following these principles, the term gas becomes a generic term, expressing the fullest degree of saturation of a body with caloric. To distinguish each species of gas, a second term is employed for the name of the base, which saturated with caloric, forms each particular gas.

Caloric is a term used for heat.

Before we proceed to the art of dying, it is necessary to consider the extensive application of this art to the dress of all mankind, and in a great degree to many of the animal creation employed in, and for the service of man. To decorate their temples, and adorn the chief magistrates, and priests, catholic countries have adopted the crimson and purple. Other nations, whether civilized or savages, have also appropriated some colour to these particular purposes. Houses likewise are decorated with rich furniture of variegated colours, in hangings, curtains, carpets, &c.

The art of dying is subdivided into several branches, distinct from each other.

1st. Woollen dyers, and in this branch, there is the grain dyers. These dyers are occupied solely in those colours arising from cochineal; for instance, scarlet, crimson, orange, buff, &c. likewise purple, or royal purple, arising from cochineal, indigo, &c. This class of dyers generally dye cloth in the piece, or a number of pieces of cloth tacked together at a time, and worked over a winch in a copper of suitable size.

2d. There are dyers who likewise dye worsted and woollen yarn of those grain colours, but they are generally a distinct branch. The yarn is in hanks, dyed upon sticks, and when in the copper, is changed end for end, that it may be kept even, which changing is performed five or six times to each turning in.

3d. There is a class of silk dyers, who are likewise grain dyers. These dye in the skein, chiefly for new goods. Some silk, and some mixed silk, and worsted goods are dyed in the piece.

4th. In dying cotton, the Adrianople, or Turkey red, forms a branch by itself, in many instances, and comes the nearest that can be, to what may be called grain or scarlet dying upon cotton; because cochineal cannot be applied to cotton to any advantage.

5th. In woollen, another branch of dying is termed woad dyers. These often have to superintend the black dye on woollen cloth, as well as the blue, from woad and indigo.

6th. There is the same distinction among worsted yarn dyers, they having likewise to do the slates, greys, &c.

7th. Nearly the same may be said of the silk skein dyers.

8th. In many places, particularly in the country, browns, drabs, stone colours, &c. constitute a branch in woollen.

9th. The same colours form a branch in callico and muslin.

10th. Black, in callicoes and muslins, is a distinct branch.

11th. The dyers, whether in London, or in provincial towns, who keep shops, and take in garments, furniture, &c. are termed rag dyers, in and by the trade.

12th. There are two or three dyers in the metropolis, whose business it is to dye black, or woollen, silk, cotton, &c. for the shops, many of them putting all their black out to be dyed.

13th. There is likewise two or three dyers, who take of these shops whatever colours they may send them to dye.

14th. There is one or two dyers famous for dying silk hose black, as a particular branch.

15th. Bombasines likewise, particularly the black, constitute a branch.

16th. Hats, black.

17th. Hats, fancy colours.

18th. Fur.

19th. Chip and straw.

20th. Feathers.

21st. Leather, Morocco and Spanish.

22d. Kid leather, for shoes and gloves, form separate branches: many more might be enumerated; few dyers who are occupied in one branch, ever meddling with the others. What they know, they have not learned from theory or theories adapted to explain the different modes of procedure, but in the branch they are occupied in, they perform what they have seen done: they execute, the processes they have been shewn and told, and that generally, without any inquiry into the causes which produce the results. I know there are exceptions, and that there are men of general information and knowledge in the various branches of dying, but they are so few in number, compared with the great body employed in the art, that it may be safely said, they amount not to one in a thousand. Not that I reflect upon this seeming indifference among individuals as this is chiefly attributable to a want of the means of acquiring information. I will venture to say, that, to this day, I know not of a book in the English language, by any means adapted to afford this knowledge. Bertholet is the best, because he is more correct than others upon the affinities of the mordants or bases, but his processes are taken chiefly from Hellot and Macquer.

Hellot, in my opinion, affords no good theory of the woad vat, nor does Macquer supply us with any upon the black process of silk; or any other writer, upon the black dye of cotton. Bancroft's Theory of the Mordants or Bases is as full, or fuller than Bertholet's. Their works are, each of them, in two volumes, from 14*s.* to 24*s.* in boards. Bancroft's object was to introduce his quer citron, or American bark for yellow, and to form the said yellow a component part of scarlet dye. In the black dye, and particularly cotton black dye, I know of no simple and concise theory consistent with chemical principles. I flatter myself, (having had about sixteen years experience,) that my observations are founded upon interesting facts. Cotton, for instance, will take fast blues from the cold indigo vat: this vat, with the combination of iron, and in a heat, no greater than the hand will bear, will easily produce all shades of greys, slates, &c.; many of these colours may be done by logwood instead of the blue vat, and in the same heat of the dye bath: so, cotton likewise, whether in pieces or skeins, may be dyed brown, fawn, drabs, &c. in consequence of the great affinity that cotton has for acetate or sulphate of iron or copperas. Haigh's Dyer's Assistant is merely a translation of Hellot on wool, whose theory, as I have observed, is obsolete, and without any information respecting silk and cotton.

White and black have been considered colours by dyers, and with propriety; for black forms a part of many, slates, greys, &c. White is seldom pure, in proportion to its clearness and purity, so will the colours be that are dyed upon its ground, as to brightness and richness in every point of view; generally according to the fineness of the thread, so is the purity of the white.

Blue, red, and yellow are admitted to be three distinct colours. In many of the browns, red and yellow are combined naturally in the drugs, from which they are produced, and so in logwood. Blue, red, and yellow, appear to be developed by copperas, or iron, whether acetate or sulphate.

In dying, the material to be dyed, forms a combination intimately with the base of alumine or alum, in some instances taking up from one twelfth to one fourth of its weight of alum, leaving the alum bath nearly tasteless. Likewise rich extract of American bark, or even weld, when the proportion of weld is in weight more than two to one of the wool, will form a triple compound with the cloth and alum, of permanent duration. These things in the outset of dying, I have considered of the first importance to be understood, and have therefore introduced the subject with a repetition of line upon line, and precept upon precept. For the importance of so doing in the dye house, I shall be excused, though perhaps not by the critics, whose candour I must solicit; having only to add, that the following communication, which I was flattered with, from one of the first chemists of the age, may operate as some proof of the sufficiency of his judgment, at least, of the chemical Theory of the Art of Dying.

16, Berkeley Square,
June 18th, 1813.

Sir,

I am very much obliged to you for your liberal communication on a subject of my lectures: I will attend to the information you are so good as to give me, in the next edition.

I am,

Sir,

Your obliged and obedient Servant,

H. Davy.

Mr. T. Packer,
20, Stamford Street, Blackfriars Road.
London, Sept. 1816.

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THE

DYER'S GUIDE.

CHAP. I.

The Nature of Cotton, Silk, Wool, and sundry Chemical Preparations used in Dying, such as Alkalies, Acids, &c.

Cotton and linen have so little attraction for colouring matter, that they require to be impregnated with a substance that has an attraction for them both, and then the dye will take effect. These connecting substances have been called mordants, or bases, such as argol, or alum, in the state of sulphate or acetate of alum, and iron also, in the state of sulphate or acetate of iron (commonly, although improperly, called copperas). Cotton being strictly a vegetable substance, is much harder to dye than either silk or woollen.

The chief difference between vegetable and animal substances is, that animal (as for instance wool) contains only a small portion of carbon, which is the most fixed elementary substance, and a large quantity of hydrogen and azote, both of which are extremely volatile; while vegetables contain a very large proportion of carbon, less hydrogen, and in general no azote.

It is the interest of every dyer to acquire as much information as possible of the nature of alum, iron, carbon, azote, hydrogen, alkalies, acids, &c. to prevent the consequences of an incorrect application of these agents in the various departments of his art.

Carbon, or charcoal, is considered as an elementary body, because as yet no means have been found adequate to decompose it; it forms the skeleton of vegetables, or their woody fibre. We must now make an inquiry concerning oxygen gas, the discovery of which was made by Dr. Priestley, in the year 1774, and is perhaps the most important ever made in chemistry.

When a metal is exposed to the air, and at the same time to heat, it loses its metallic lustre, and acquires the form and properties of an earthy substance. If this change be produced in a given quantity of *atmospheric air*, the calcination can only be carried on to a certain degree; and on examining the air which remains, we shall find that it has lost the whole of its oxygen, and that nothing remains but the azotic gas. The calcination of metals is nothing but their union with oxygen, and is properly called their oxydization.

If charcoal be mixed with the metallic oxyde, it will unite with the oxygen, and form carbonic acid, which will fly off in the form of gas, while the metal will be reduced; from this it appears that oxygen is a part of the atmospheric air which we breathe, and that azotic gas (or nitrogen, as some call it) is another part of atmospheric air.

Combustion, or the burning of any combustible body, cannot take place without the presence of oxygen; but we must now contemplate the properties of azotic gas or air, forming as it does about three-fourths of the atmospheric air; and the other fourth, as has been observed, is oxygen.

Oxygen contains light, caloric, or heat, and it is this part of atmospheric air which decomposes or destroys all fugitive colours. Azote contains caloric; and its particular base is capable of becoming solid, and is supposed to be the principle of alkalies, as oxygen is supposed to be that of acidity. The atmosphere, therefore, is an immense reservoir of acidity and alkalescency, without being itself either acid or alkali. But before we speak any further of acids or alkalies, we must notice hydrogen, which combined with caloric or heat, forms hydrogen gas, formerly called inflammable air. It was discovered by Mr. Cavendish, in the year 1767: its base is called hydrogen, because it is one of the component parts of water; or, more properly, it is the base of water. It is obtained in the most pure state from the decomposition of water by means of metals; as, for instance, when one hundred parts of water are made to pass through a red-hot iron tube, fifteen parts of hydrogen gas will be procured, while the inside of the tube will be found converted into an oxyde, and to have gained eighty-five parts in weight.

Again, when eighty-five parts of oxygen gas are burned with fifteen of hydrogen gas, both gases vanish, and one hundred parts of water are formed.

Hydrogen gas is about twelve times lighter than common air, and therefore is employed for raising balloons into the atmosphere.

Hydrogen is improper to breathe, as it would destroy life; but, united to azote, it forms ammoniac, or volatile alkali, and as it is highly probable that the other alkalies are composed of earthy bases united to azote, it will be necessary to consider the properties of the different alkalies.

1st, Their taste is acrid, burning, and urinous.

2d, They change the blue colours of some vegetable infusions to green.

3d, When mixed with flinty substances, and exposed to considerable heat, they form glass.

4th, They render oils miscible with water; they effervesce with some of the acids, and form neutral salts with all of them.

Alkalies are divided into fixed and volatile.

There are two species of fixed alkali: the vegetable alkali, or potash, and the mineral alkali, or soda.

The vegetable alkali may be extracted from various substances, but chiefly from the ashes of vegetables or tartar. Those procured from tartar are generally known by the name of salt of tartar.

The mineral alkali, or soda, is the base of sea salt; it is most usually procured from the ashes of marine plants. This alkali differs from the vegetable in the following particulars. 1st, It is less caustic. 2dly, It effloresces in the air, instead of attracting moisture from it. 3dly, It forms octangular instead of quadrangular crystals. 4thly, It forms different neutral salts, with the same acids.

There is reason to conclude, that the combination of azote with lime forms potash, while its union with magnesia forms soda.

Azote, combined with oxygen, forms the nitric acid. We will now take a brief view of the properties of acid bodies.

1st. They excite a particular sensation on the palate, which we call sour.

2dly, They change the blue colour of vegetables into red.

3dly, All of them, except the carbonic acid, effervesce with the mild alkalies.

Oxygen forms the principle of all acids; their difference depends upon the substance combined with the oxygen. Nitric acid is composed of four parts of oxygen and one of azote, chemically combined.

Carbonic acid gas is thus formed: when charcoal is burned in a quantity of oxygen gas, exactly sufficient for its combustion, both the charcoal and oxygen gas disappear, and a quantity of elastic fluid is found in the vessel, which is equal in weight to both. This air or gas is called carbonic acid gas. It is an acid elastic fluid. It has great affinities to lime, to the alkalies, and magnesia; and constitutes half the weight of chalk, limestone, and marble.

Carbonic acid is found to possess the following properties: 1st, It extinguishes flame, and, like azote, kills animals immersed in it. 2dly, Its specific gravity is much greater than that of common air, therefore may be poured out of one vessel into another, like water. Cider, beer, and other fermented liquors, owe their briskness to the carbonic acid which they contain.

Sulphur is a very combustible substance; dry, brittle, and of a fine yellow colour. It is found in great quantities throughout nature; sometimes in a state of purity, but most commonly combined with some of the metals. It is frequently formed by the decomposition of animal and vegetable substances; and particularly where large quantities of vegetables are putrefying.

A small quantity of oxygen and sulphur forms sulphureous acid; a greater quantity forms sulphuric acid.

The principal vegetable acids are the acetous, or vinegar; when distilled and concentrated, it is called radical vinegar, or acetic acid. The bases of the acetous acid are carbon, hydrogen, and a little azote.

Wood, when burned or distilled, yields a particular acid, called the pyroligneous acid, which is used by calico-printers to dissolve iron.

Earth of alumine, alum, or the argil, is soft to the touch, adheres to the tongue, and hardens in the fire, contracting in its dimensions: it constitutes the greatest part of clays. With the sulphuric acid it forms alum, and dissolves in fifteen times its weight of cold water.

On the Formation of Acetate of Alumine.

Sugar of lead, or acetate of lead, is mixed with sulphate of alum. In this case a double decomposition takes place; the sulphuric acid unites with the lead, and forms sulphate of lead, which is precipitated and thrown away, and acetate of alumine is thus procured.

Pyroligneous acid boiled with iron, forms acetate of iron.

Iron is a component part of a fruitful soil, in many instances; alumine or argil likewise compose three-eighths of such soil, lime three-eighths, and sand two-eighths.

Having thus briefly explained the meaning of *mordants*, or bases, as, for instance, alum, and iron; likewise of acids, of alkalies, of oxygen, and hydrogen, oxygen being the principle of acids, azote of alkalies, &c.—we proceed to the application of them. First, in respect to muslins and calicoes, the alum is mixed with gum, or a paste, and carried to the piece, as will be described in the Calico-Printers' Mordant, and then immersed in the dye bath; it thus receives the base, or mordant. If the base be alum, and the dye bath madder, then where the block strikes the pattern with the alumine base the colour will come out red; the remainder part will clean and bleach white. If alum and iron form the base, the colour will be purple; if iron alone be applied, and galls, shumac, logwood, &c. are the component parts of the dye bath, then it will be black.

On Silk.

When silk is deprived of its gum, so as to acquire the greatest possible degree of whitenes still it is necessary to have different shades o white—some yellow, some blue, and others reddish—distinguished into five denominations, viz. China white, India white, thread or milk white, silver, and azure white;—all these whites, although differing from each other *by very light shades* are nevertheless apparent, especially when compared with each other, which shall be shown in the process of dying silk.

On Wool.

Wool (supposing it fit to receive the dye, and that it is intended to dye it yellow) should boil two hours, with one-twelfth or one-tenth of its weight of sulphate of alum, observing proper precautions, and the use of a sufficient quantity of prepared weld plant boiled, &c., or of American or quer citron bark, as shall be shown in the processes of the different yellows; this decoction will form the dye. If it were yarn, and the threads cut in two, it would be found to be dyed throughout, and of a body and richness in proportion to the correct application of the various ingredients, and with due regard to time, weight, measure, &c. The quantity of alum, and of the weld plant used will be found to be very considerable, from one-twelfth to a fourth of alum, and according to the French regulations, four or five times more weld than the quantity of the wool! When a process of dying has been scientifically performed, the wool will take the alum, so that the bath will hardly taste of it; and afterwards take the colour of the dye bath out of it; so that the remaining fluid, put into a glass, will be nearly like water.

On bleaching Linen, Cotton, &c. to deprive them of their resinous Brown.

This was formerly done by means of the alkali, or American Potash, which was a tedious process. The cotton being boiled in a solution of potash, was washed, then spread upon the grass, watered with scoops, and exposed to the atmosphere for two or three months. This process was improved by Berthollet, a French chemist, by putting six parts of powdered oxyde of manganese, sixteen of sea salt, and twelve of concentrated sulphuric acid, diluted with an equal quantity of water, into a leaden retort, and distilled. The product of this distillation is oxygenated muriatic acid, which being conducted to a vessel containing the cotton goods, produced the same effects as the former process, and bleached as much in two or three days as was bleached before in two or three months: this last process has been further improved by a powder now used, which is composed of oxymuriate of lime.

This business constitutes the art of a bleacher, as the cotton dyer has seldom any thing to do with it, except in piece goods of rough cambric, which he has sometimes to dye black, as they come from the bleachers in a state which they call *once boucked*, and sometimes he has them just as they come from the weaver; in which case, if for black, they need not be bleached white, but should be boiled in potash, to take out the grease, &c.

The drugs applicable to dying cotton, linen, silk, wool, &c. are

Indigo
Galls
Shumac
Weld or Woulds
American Bark
Cochineal
Lac Dye
Solutions of Tin
Verdigris
Potash
Pearl Ash
Alum
Argols
Tartar
Acetate of Alum
Sulphate of Alum
Acetate of Iron
Sulphate of Iron
Sulphuric Acid
Muriatic Acid
Nitric Acid
Turmeric

Animal Gall
Orpiment
Archil
Safflower
Woad
&c. &c. &c.

On Dye-Houses, and Water proper for Dying.

The dye-house should be as spacious as possible, for the proportion of work intended to be done in it, and as near as possible to a clear running stream; the floor should be a mixture of lime and cement, and sufficiently inclining, that the water, spirit-baths, old contents of blue vats, &c. may run off freely, when thrown down.

It is impossible for a dyer to be too particular with respect to the water he uses, for some pump and well waters contain iron, which would be injurious to most colours, while, on the contrary, it would be very advantageous for blacks, for browns, slates, greys, &c.

In order to discover whether the water contains iron or not, a little tincture of galls, or prussiate of potash must be dropped into it, and if a purple or blue colour be then produced, we may be assured that it does contain iron.

For dying delicate colours, the best water should be boiled with bran in a bag, when all the contents of the water, inimical to dying, will rise to the top in the form of a scum, and may be taken off with a ladle or bowl, before it boils; for want of bran a little alum will answer the same purpose, when alum is not inimical to the colour intended to be dyed.

On the Calico-Printers' Mordant, or Base, of Alum, for Yellow and Red Goods, either for Printing or Dying.

Take one gallon of hot water, soft and pure, three pounds of sulphate of alum, one pound and an half of acetate or sugar of lead, mix these together, and keep them for two or three days, to incorporate or act upon each other; often stirring them during that interval; then add two ounces of pearl ash, and the same of clean powdered chalk or whiting; after a time the settled clear liquor is drawn off, which is now become acetate and not sulphate of alum, and when used, is thickened, either with paste of flour, or gum Senegal. A block, or a press similar to a copper-plate press, for paper, but much larger, in the length and diameter of its cylinders, and having the copper-plates in proportion, is employed to spread the acetate of alum, from an utensil called a sieve, being in form of a sieve, but not porous, while a boy or girl, termed a Tearer, works it smooth; when smooth on the sieve, the printer applies his block, and charges it with this acetate of alum;

then the block so charged, is correctly put on the cotton cloth, which lays upon a blanket, spread upon a table; the block is then struck with a small mall or mallet, once or twice, by which, or by the pressure of the rolling-press, if copper-plate, the acetate of alum is driven into the pores of the cotton cloth mechanically: the cloth having received this application of acetate of alum, is next taken and hung up in a hot stove, and dried by a high degree of heat, the alum shrinks, and the vegetable acid is driven off by the heat; the goods are then ready for the madder copper, if for red; or for the weld copper, if for yellow: of late the colour is previously prepared, and applied at once, in more instances than is prudent.

Wool readily takes the alum at a boiling heat, and the sulphate of alum is not found unfit for wool; in many instances, and in others where it might be so, it is corrected by the tartar, or argol, used with the sulphate of alum.

Yellow and red produce the orange, red and blue the purple; but upon cotton, a scarlet, purple, or a crimson cannot be produced, any way to equal either of those colours on wool or silk;—yellow and blue form the green.

On Dying and Redying Cotton Furniture Yellow.

If the furniture, such as rough or finished cotton or cambric, intended for yellow linings, for bed or window curtains, &c. is in a perfect bleached state, which is now generally the case, according to the number of the pieces, so must the size of the copper be to boil the weld in for the yellow dye. A small copper that would hold four or five pails would do for three pieces of twenty-four or twenty-eight yards each; the weld may be bought by the half bundle, the bundle, or load. Half a bundle would be enough for the above quantity, if a moderate yellow is wanted. The weld must be increased or decreased according as the pattern approaches a straw, a canary, a lemon, or towards a gold colour or orange. The weld must be boiled about twenty minutes, and the liquor strained off into a proper tub, then the weld reboiled; and, while that is going on, three tubs, termed flat tubs, being wine pipes cut in two, must be got ready, by being particularly clean, and previously seasoned to the work. One is to receive the boiled weld, with some cold water to regulate it, to what the hands can bear; the other tub is to receive water and as much alum liquor as will colour it, and make it taste strong; and the third is to have clean water in it, to wash the furniture off in. Whatever yellow is in fashion (or any fashionable colour) it has generally a fashionable name; but if the dyer, by experience, can proportion his drugs to the weakest, and from that to the fullest shade, let the name be what it may, after he has a set of patterns of his own dying, he sees upon the first view of any colour how to set about it. In the present instance let the pattern be a moderate full colour of yellow; then put all the first boiling of weld in the first tub, and cool down as was before observed: two or three people should then work the pieces quick from end to end by the selvages, that they may be even: two may accomplish this, and one must be an expeditious hand, to work them and keep them even. When they have been edged over six or seven times, they are to be folded out upon a board laid over the tub, and wrung as dry as possible between two men. When they are all out, they are passed in the same manner through the tub of alum, and, after six or seven turns, they are to be taken out of the alum liquor, wrung as before, and then washed off. By this time, the second weld liquor will be boiled, some of the first must be thrown away, and the second boiled weld liquor added in its room; the goods are then passed through as before, wrung out, the alum liquor strengthened, and then the goods passed through the said alum liquor, wrung out as before, then washed off, in the wash-off tub, having changed the water. In some instances verdigris is used instead of alum; and, in other cases, is used in addition to alum; and, for some shades, old fustic wood is used instead of weld, and blue vitriol, or sulphate of copper, instead of verdigris.

The alum solution, and the sulphate of copper, and the verdigris, or acetate of copper, should be always ready. It would be necessary to have a tub for each, proportioned in size to the work that is to be done; but larger for the alum than for the other two. The copperas, or sulphate iron, will also require a tub as large or larger than that for alum. The sulphate of iron or copperas is used in some dark greys, browns, slates, and in all blacks.

When the yellows are dyed, and wrung as dry as possible, they should be taken into a close room or stove to dry, particularly in London, because of the smoke, and especially in the winter. A German, or other stove, should be introduced into the room. The size of the room or rooms, the stove or stoves, must be in proportion to the quantity of the work. When the goods are dry, they must be sent to the callenderers, if people choose to have them callendered; yet the general and better way is to stiffen them with starch, after they are finished dying, and before they are dry; and, when dried, they should be sent to the glazers instead of the callenderers, excepting where the two branches are carried on by one and the same person.

Furniture that has been originally yellow, and become faded, after having been exposed to the sun and weather, being faded in the folds, &c. is required to be re-dyed and re-glazed. In this case, it is best to dye it rather a fuller shade of yellow than the original, and the way to proceed upon it is this: A large flat tub, such as was described before for dying in, is to be filled with water to three-fourths of its contents, sufficient oil of vitriol, or sulphuric acid be added, to make it taste strongly sour. After being well stirred, the pieces are put in, and worked in this sour liquor; and the yellow dye in consequence is stripped off If the sours is not strong enough, more oil of vitriol must be added, with the caution of well mixing the vitriol and water, and the goods must be passed through again; by this means the yellow is discharged. They are then taken out on a board, upon the tub, wrung between two men; then washed off, wrung and washed off a second time, then they are fit to dye. It is still to be understood that any faded or worn-out colour, or that of goods more or less decayed, seldom becomes so bright as the colour which a new piece of goods receives from the same dye.

Some colours to be discharged for redying, require the application of oxymuriate of lime, particularly where madder, or galls, &c. have formed constituent parts of the dye. In this case, if a bleacher is near, it might be more economical to let the bleacher have them, to perform that part of the process, as the oxymuriate of lime is very pernicious to the lungs, and requires every precaution in the process, as it regards the health of the operator: and, besides this, will not pay the expense and trouble, unless the business is upon a considerable scale. However, if the dyer thinks it prudent to perform this operation, then the oxymuriate of lime, or bleacher's ashes, &c. may be had at the drysalters, and dissolved in a cask, and the clear liquor used in proportion to the quantity of goods intended to be discharged, which, when done, should be washed off in two waters at least before they are dyed.

CHAP. II.

To dye Cotton Saxon Blue, otherwise called Chemic Blue.

THIS is performed by sulphate of indigo.

This preparation is thus made:—Put into a brown stone glazed earthen pot four pounds of good oil of vitriol, be particular, and have *sulphuric acid;* add to it twelve ounces of fine indigo, finely ground and sifted, stirring the mixture *very hastily and frequently.* Break the lumps, if it should get lumpy before you have thoroughly mixed it, with a glass rod, or with a stick, the bark of which has been taken off: if for wool or silk in forty-eight hours it will be fit for use; but for cotton it is unfit to use till the acid of the vitriol is neutralized by an alkali. Some use whiting, but that precipitates and wastes the indigo; others use magnesia, but this is expensive; some again use pure potash, prepared thus—take American pot or pearl ash about seven pounds; put some of it into a brown stone glazed jar, or rather a pan, without any neck or curtailment at the top;

upon the ash you must put some quick lime, fresh burnt, then alternately ash and lime, slacking the lime with water as you put it on the ash. When it is altogether, let it stand about two hours; you should have a brown stone earthen vessel, with a hole at the bottom, of larger dimensions than the other; put into this a piece of coarse linen, to prevent the lime, the impurities, or any foreign bodies, from running through the hole; then upon the bottom put some of the mixed lime and ash, well compounded together, and placed gently upon the linen so as to be sure of its keeping its place, and performing what is required, viz. letting the liquor pass through clear. As you put in the mixture add some water at times, so as to keep it just covered, and leave room at top for the swelling of the materials, as the lime especially will swell. Water must fill the whole, and cover the lime, &c. which will be known by the bubbles ceasing to rise: when it has stood twelve or fourteen hours, having occasionally added water as the other had subsided, by being absorbed, some may be drawn out.

To determine whether the carbonic acid has entirely quitted the potash, take some of the fluid which was drawn off into a wine glass, and drop a drop of oil of vitriol into it; if the carbonic acid is entirely with the lime, the acid of the vitriol will enter the fluid in the glass quietly without any other appearance than so much water; if you have still any doubt, add a few drops of the oil of vitriol successively. If the carbonic acid is not all absorbed with the lime, but some still remains with the fluid potash, then when the vitriol is dropped into the glass it will cause an effervescence or seeming fermentation in the ley; if so, it must be returned to the mixture for a longer time, and if necessary more slacked lime added. When it is fit for use all of it is to be drawn off, and more water may be added, and left to act till it may be wanted. It is best to keep it close from the air. It may be known when the alkaline principle is exhausted, by taking a piece of paper stained with the juice of the blue flowers of violets, or the blossom of the mallow, which is thus prepared; pound the blossoms with a glass pestle and mortar, and squeeze the juice into a tea-cup, then with a small hair pencil cover a sheet of white paper with this juice, and dry it for use; all acids will turn it red, and all alkalies will convert it to a green colour.

As long as any strength remains in the fluid, as to its alkaline principle, the potash fluid will turn a bit of this paper so stained, *green*.

You may likewise ascertain the comparative strength between one solution of these ashes and another, and thus know how to purchase to your advantage: for instance, take a wine glass full of the potash ley, drop therein a few drops of oil of vitriol, stir it with a glass rod, or clean bit of tobacco pipe, apply a bit of the test paper; if it appears green, more acid must be added, and stirred again; then apply the test paper the second time; if still green, a few drops more must be added, and so continue till you find that the colour of the paper is by no means altered to either green or red. The ley is then neither acid nor alkali, but neutral, or a combination of both, brought to a point of saturation; a few more drops of the acid would occasion the test paper to take a red instead of a green colour, which would distinctly show the power of the acid to prevail.

Treating the different leys in this manner, then counting the number of drops wanted to neutralize them, the strongest ley will be found to be that which required the greatest quantity of acid to overcome the power of the alkali.

The alkaline leys are also judged of by their specific gravity or weight, comparative to water.

	oz.	dr.	gr.
An English pint of spring water weighs about	15	3	12
A strong ley of the same measure	17	6	18

The difference between the two, is two ounces three drachms and six grains, so much alkaline salt being contained in a pint of such ley.

To return to the dying of cotton chemic blue, take some of the blue liquid prepared with indigo and oil of vitriol, and put it into another pan of the same manufacture, large enough to hold two or three times as much as you intend to put in, in order that you may have room to stir it; you must then add some of the potash or alkaline liquor by degrees, till, after several trials, you find it does not taste sour; or if you do not like to taste it, take a small slip of cotton, off the fag end of any piece of calico or muslin, and dip it in, after having it wetted out in warm water; if the acid is neutralized, the cotton will be sound; if not, it will be tender, *when dried.* If the acid predominates much the cotton will be rotten as tinder, but when perfectly strong and sound after being dried, then the liquid is fit to dye cotton and muslin.

Take the goods which should be first wetted out and wrung, then work them in the flat tub of water, with a little of this blue added and well stirred in proportion to the shade wanted. From half a pint to a pint of the liquid blue is sufficient for two pieces of twenty-four or twenty-eight yards each, if not of a very full pattern.

Blue, when dyed, should be dried in a cool stove; and if book muslins, framed; and furniture, stiffened, glazed, or callendered.

Saxon, or Chemic Green.

The same blue vat will do for green, but it is best to make another, by putting only eight ounces of indigo instead of twelve to four pounds of oil of vitriol. If the preparation has been made two or three months it is the better, having been often stirred before it was neutralized with the alkali.

Boil of old fustic a strong decoction, which should always be ready at hand as a store, keeping plenty according to the work done, including cotton, silk, and woollen goods.

Mix some of the chemic blue with the decoction of the old fustic in the following manner, put into a tub, six pails of soft and clear water, then a pint of blue (neutralized), then six pails of the decoction of fustic; stir these three together well. Some dyers will add a little weak alum liquor, till it just tastes, before they put the blue in. It should be but little, or otherwise it will precipitate the fustic: this mixture should stand two hours to settle.

The muslin or calico,say two pieces twenty-four yards each, should, with the usual precautions, be passed through a strong decoction of old fustic or tumerick, hot as the hand will bear, as the yellow was before. They are then to be taken out, and the green mixture before-mentioned to be added, in proportion to the fulness of the green required; when finished, whether for the callenderer or glazer, they should be dried in a stove moderately warm.

These two colours are very fugitive, *especially upon cotton goods;* but sometimes the customer will not go to the price of the fast green or blue, hereafter to be described.

For Saxon blue the indigo of Spanish America is the best and cheapest; it is termed *Guatimala*, from a province of Spanish America; if good, it will be of a dark violet colour in the inside; when you break a lump of it, by rubbing it upon your nail, it will appear coppery; the lighter it weighs the better. It is the produce of a plant called nil, or anil; it is put into a tub of water, that is, the whole plant, the leaves, bark, and flowers; after the expiration of some time the water begins to heat and bubble, then grows thick, and assumes a violet colour. By means of a cock, the water, impregnated with the whole colouring substance of the plant, runs into a second tub, called the *beater*, where it is beaten by a battering mill; the indigo is thereby precipitated so completely, that the water loses all colour, and becomes as clear as common water. A cock is then turned on till the water runs off level to the surface of the blue dregs; a lower cock is afterwards turned, in order that the whole substance may run into the third tub called the repository, because in this tub the indigo remains to dry; it is then taken out, and moulded into cakes or tablets, &c. See P. Labat. Hist. of the Antilles.

In the East Indies the leaves of indigo are fermented for the space of four days; in America, on the contrary, the fermentation is generally completed in forty hours, which plainly proves that the plants there used, contain a much larger quantity of volatile alkali than elsewhere, by which the operation is rendered more difficult, owing to the danger of not stopping in time, and thus preventing putrefaction, which is frequently the cause of failure in this operation.

To set a cold Indigo Vat for Cotton, &c.

Put three pounds of slacked lime sifted into six quarts or more of water, boiling hot, stir it well for some time, and after it has settled draw off the clear liquid; then dissolve in this clear liquor three pounds of green copperas, stirring it well till all is dissolved; then let it settle till next day: have ready a cask of deal, because oak would blacken and tarnish the dye, by means of the iron or copperas. Put seventy-five gallons of water into this cask, add the lime and copperas to the same, and have three pounds of indigo well ground ready at hand, dissolved in three pints of strong solutions of potash, such as was stated to be prepared for neutralizing the chemic blue; put this solution of indigo and potash into the tub of water, lime, &c. after this is well stirred and left to settle, it produces a deal of froth; but the liquor takes a fine green colour, which turns to blue when exposed to the air.

It will do equally as well with soda, which is the mottle soap manufacturer's lye, made from barilla instead of potash.

Another Indigo Vat.

To five hundred quarts of water put from seven to eight pounds of indigo in an iron boiler; boil the indigo with sixteen pounds of a decotion of potash, and eight pounds of lime; after the lime and potash have been in contact, as in all these instances it should be, from twelve to twenty-four hours, to take away the carbonic acid from the potash, the clear decoction is what the indigo is to be boiled in; and the indigo is to be pounded and ground extremely fine in water, before it is put into the alkaline solution of potash. Then it is to be boiled till the whole of the indigo rises to the surface like a cream; and till, in striking the bottom of the boiler with a stick, it appears by the sound to contain no substance. While the indigo is boiling you must slack the same quantity, namely, eight pounds of lime in about twenty quarts of warm water, and sixteen pounds of copperas dissolved in this lime water. The vat being half filled with water, the solution of lime and copperas is to be put into it; the indigo solution is then poured into it, minding at different times to rince the copper with some of the lixivium reserved for that purpose, in order that nothing should be lost, when all are together in the vat. This being filled to about three or four inches of the edge, is to be stirred two or three times a day, till it is fit for dying, which it will be in about forty-eight hours, and often sooner, according to the temperature of the air, by which the fermentation is more or less accelerated. When the strength of the vat is exhausted, it must be replenished; if the liquor becomes black, it wants copperas; if yellow, lime is wanting: when the indigo is far spent, more must be added in the same manner as at first, according to Hillott and D'Apligny.

In this vat, as respects the blue dye, if it is to dye muslin, calicoes, &c. the form should be square, about two yards long; one yard to one and a half wide, and from seven to eight feet deep, and the pieces are to be hooked into a frame. It will be necessary to have two or three such vats, where much work is done, because they would work in succession; by stirring them previous to working some hours, the weaker would do the lighter shades, the stronger the fuller colours. If the vat is in order, the goods always come out green and turn blue in the air: this should be ascertained by small patterns, previous to working of the whole. When any goods are dyed in these vats, if not full enough at one dip, they may be left a certain time, then dipped again, and left according as they seem to require it. When they are blue enough, and fully aired, they are to be taken from the hooks, and well washed off in two or three fresh clean waters, or at a wash-wheel in a clear running stream; when perfectly clean, they are ready for the callenderer or glazer.

On dying Cotton fast Green with the Cold Indigo Vat and Weld.

After dying the muslin blue in the blue vat, then a proportion of weld is boiled in the same manner as for fast yellow. According to the fullness of the blue ground, and of what the green is to be, so much weld must be boiled, and a proportion of alum used; the goods, after being worked in the same manner by the selvage, must be washed off; and stiffened, if for the glazer, but not if for dress; but framed by the muslin dresser.

Another Cold Blue Vat for Linen and Cotton.

The indigo is to be ground and put into warm water with copperas, in quantity twice the weight of the indigo, and the same quantity of fresh burnt lime as of copperas; let the water be only sufficient to mix it thick at first; keep it stirred; and as it becomes dissolved and green under the surface, increase the water, often stirring and trying it, by putting in a pattern between the stirrings, at some hours distance, between each pattern, and increasing the water, then in twenty-four hours it will be fit for use.

Solution of Indigo for penciling printed Muslin, by Haussman.

To twenty-five gallons of water add sixteen pounds of indigo, and thirty pounds of carbonate of potash; when mixed and placed over the fire, as soon as the mixture begins to boil, add quick lime by a little at a time to render the alkali caustic; then twelve pounds of red orpiment, and boil till it will give a yellow colour to transparent glass. Were I to make this solution of indigo, I would have the alkali first made caustic by lime, and then put the clear liquor to the other materials.

On dying Cotton fast Buff.

Take a brown stone pan or pipkin, glazed; it must not be the common glazed wares, because these are glazed with lead, and the acids decompose the glazing, set the lead free from the vessel, and cause it to enter into combination in many instances, with the ingredients, and sometimes would totally spoil and disappoint the dyer or chemist in his process. The stone ware, if used with care, will stand fire; this, instead of being glazed with lead, is glazed with sea salt, viz. muriate of soda. Having a proper vessel to hold about half a gallon or a gallon, put into it nitric acid, commonly called double aqua fortis, half the vessel full, (it is none the worse for keeping after it is made), add by small degrees, to this acid, either old horse shoe nails, from the farrier, because they are made of the purest iron, or the cuttings of tin, as it is called, at the tinman's; for this is the purest iron, though only covered with tin, and the little tin on the bits of plate, as it is called, is not inimical to the dye. Observe not to put much in at a time, or to stoop near to it, as red fumes or smoke would arise; and if the iron is added in great excess, most of the liquor would come over the top of the vessel. The fumes are very destructive to the lungs, and also contaminate the air; therefore, begin to prepare the liquid long before you want it, by dropping, hourly, small quantities of the iron at a time, into the aqua fortis, and then no very perceptible fume will arise. Continue this process, till, by stirring with a glass rod or thin tobacco pipe, you find that it gets much slower in dissolving; by keeping a little of the iron at the bottom, and occasionally adding aqua fortis, you may always have this preparation ready, according to the demand you may have for it. The way to use it is thus:—having a copper of hot water ready, put a part of it to some cold, in a flat tub, till the mixture is as hot as the hand will bear; then, according to the paleness or fullness of your pattern, put in some of your dissolved iron, stirring it to make it mix well. Begin with about half a pint for two pieces, of twenty-four yards, as it is best to be under at first, remembering that you may at any time add; when, to diminish, is by no means so easy: then have ready a flat tub of water, of the same temperature as the hand will bear, into which put some settled and clear solution of pearl-ash, and have ready likewise another tub of clear cold water, to wash off in:

then pass the pieces (always taking the precaution to have them well wetted out in one of the tubs of hot water, before either the solution of iron or pearl-ash is put into either of them), then pass the pieces through the solution of iron, six or seven times, edging them over by the selvage to keep them even; then wring them out (first folding them even upon a board), wash them off, then pass them through the solution of pearl-ash, then wash them off again in fresh and clean water, and you have a permanent and bright buff, as good a colour as can be dyed upon cotton. Here we may see what an affinity iron and cotton have to each other, when iron is in a state of solution, through the medium of the acid; although the colour is not so beautiful in every instance, yet let the acid that has dissolved iron be what it may, cotton will imbibe the iron from it. Water when pure, at the temperature of about 70 and upwards, will dissolve iron. What is left of this solution of iron, and the pearl-ash, may each be kept in a separate deal tub for future use.

On dying Cotton Pink.

Take safflower, in proportion to its goodness, and the quantity of work to be dyed; put the safflower into water, pure and clear; here it must be trod till the water becomes fully charged with a kind of extractive yellow colour. It is best to put the safflower into a strong linen bag or sack; a sack, containing sixty pounds, will take a man two days to wash it clean: if done in a clear running stream, the yellow colour will run away; if you have a small quantity in a tub, it must be let out at a plug-hole, which every flat tub should have. It must be worked or trod till all this yellow colour is got out of it, or else the pink colour that is drawn from it afterwards will not be *bright.* The sacks used in washing, after a time, become dyed of a cherry colour. When thoroughly washed, take it out of the bag or sack, and put it into a deal tub or trough, and add about six pounds of pearl-ash, to one hundred pounds of safflower; weigh it before it is wetted; let the ash be well melted in water, and pour part of the clear off, and thoroughly well mix it with the safflower; then after having stood for some time, strain it through a cloth or sieve, into another deal trough. The whole solution of pearl-ash should not be put on at once, but at separate times. If there should be reason to believe that the safflower would yield more colour by having a small quantity more of the pearl-ash melted, it may be done; it should be used cold to the safflower and carbonate; or mild potash or pearl-ash is better than caustic. By putting the solution of pearl-ash on the safflower at different times, it will be discovered when the fluid filters through the cloth or sieve, free from colour.

The colour is of a cherry hue, and is resinous; therefore the water dissolves but little of it, and the mild alkali or carbonate of potash is added, to dissolve this resin.

To overcome the influence of the pearl-ash, which yellows the red colour, some crystal of tartar is pounded fine, and dissolved in boiling water, and added to the liquor after being cooled down nearly cold. In the south of France they use lemon juice.

The colour is then raised by the tartar, from the effects of the pearl-ash, and is mixed with cold water, in proportion to the fulness of the pattern desired, and worked six or seven times in it, as in other colours. What is left of the colour, must be taken up with some skein cotton and dried; and may be added to water, upon another occasion, by saturating the acid with a solution of pearl-ash, which will strip the cotton of the dye. The solution of tartar will again redden the colour, from the yellow of the pearl-ash; this must be done if any is remaining, for it will not keep in a fluid state. I shall not describe any other process of cotton till I have treated of wool and silk.

CHAP. III.

On dying Silk.

FIRST, on aluming silk, forty or fifty pounds of alum being dissolved in a copper of hot water, is then put into a tub of forty or fifty pails in size, and stirred and well mixed, lest the cold water should crystalize the alum, and spot the silk; when this happens, dipping in warm water dissolves the alum. The silk should be alumed cold, for if hot, it hurts the lustre of the silk; the alum is used for certain reds and yellows, and the shades arising from them, but not for blue.

The blue Vat of Indigo for Silk.

"This should be so contrived, that heat may be applied to it, which is mostly done now by steam, both for woollen woad vats and indigo vats. For silk, take eight pounds of the finest indigo, and six of the best pearl-ash, and from three to four ounces of madder for every pound of ash, besides eight pounds of bran, for the whole, worked in several waters to take out the flour. When washed, and most of the water squeezed out, the bran is to be put at the bottom of the vat. The pearl-ash and the madder is then mixed, by bruising them roughly together, and boiling them a quarter of an hour, in a copper containing two-thirds of the vat; the liquor is then suffered to rest, and the fire damped. Two or three days previous to this, the indigo is steeped in a bucket of warm water, washing it well, and even changing the water, which has a reddish cast. Some dyers begin by boiling the indigo in a ley, consisting of one pound of pearl-ash, and two buckets of water; they afterwards pound it in a mortar quite wet, and when it becomes like paste, fill the mortar with the liquor before boiled, and still hot, bruising it for some time. They then suffer it to stand a few moments, and then pour off the clear, into a separate boiler or into the vat. The same quantity of the mixture is then poured upon the indigo, remaining in the mortar, bruising and mixing it well; and then, as before, pouring off the clear into the boiler, and this is repeated until the whole of the indigo is dissolved in the liquor; the whole of the liquor in the boiler is then gradually poured into the vat, on the bran at the bottom, adding afterwards the remainder of the composition grounds and all. After stirring and raking for some time, it is left without heat, till it is cool enough to bear the hand in, when a little heat is added to keep it as it is; and so continued till it begins to turn green, which is easily known, by trying it with a little white silk. When the green begins to appear, it should be stirred with the rake, then suffered to stand, till the brown and coppery skim, which rises upon the surface, shews the vat is come to. But as it is necessary to be very certain of this, the scum should be well examined; and if, when blown aside, it immediately forms a fresh scum, it is as it ought to be. In this state it is to stand for three or four hours, then a new composition is made in order to complete it. For this purpose, as much water as is requisite to fill the vat is put into a copper, boiling it with two pounds of pearl-ashes, and four ounces of madder, as at first. This new liquor is poured into the vat, raked and mixed, and being left to stand for four hours, it is then ready for dying. When a vat or vats, is set for green, double the quantity of madder is to be added; it works much greener than the other, and gives a more permanent colour, equally pleasing to the eye; when exhausted of its colour, it becomes brown, almost the colour of beer; the other becomes blackish. The size of the vat, for the above quantity of indigo, &c. is about five feet deep, two feet, or two feet six inches in diameter, at top; and one foot and a half, or two feet, at bottom; in the form of an inverted sugar loaf.

"In order to produce different shades of blue, the silk intended for the darkest, should be first dipped in the fresh vat, and so on to the lightest; as the vat weakens, the silk should be kept in longer, till the vat appears exhausted, serving only for the lightest shades. When it begins not only to be weak but dull, it is then necessary to feed the vat, with a fresh composition, as follows: a decoction of pearl-ash, one pound; madder, two ounces; a handful of washed bran, boiled together, a quarter of an hour, either in water or in a portion of the same vat, if it is yet sufficiently full to afford it; after this mixture is added, it should be well raked, and suffered to rest, two or three hours, more or less, before the dying is again resumed. For the finest blues a fresh vat is the best, and if only pale blues are required, a vat set on purpose, with less indigo, will answer better than a strong vat that has been weakened, because, though weak, it will give more lively colours." MACQUER.

On dying Violet, Royal Purple, &c. on Silk.

A copper is boiled with a quantity of archil, in proportion to the colour required, from two to four times the weight of the silk; when the archil has boiled about ten minutes, the fire is damped, the archil is left to settle, and the clear liquor is put into a vessel of convenient size, in which the silk is returned and worked with care, to keep it even. You have a small corresponding pattern at work with the mass, or quantity of silk that you intend for purple, which at times you put into the blue vat, to regulate your depth of archil ground; as the purple is a compound colour arising from the union of the blue of indigo, and the red of archil. When you have got the red of the archil deep enough, you then wash it off, and put it into the vat with due precautions; the fulness of the archil ground, and the depth of the blue, must be regulated according to the patterns, which are to be matched.

On dying Silk Lilac.

As lilac is, and should be a bright light shade of the violet or purple, to give it the blue requires great management; the vats being generally too strong, it is best to mix a little of a new rich vat, with some pearl-ash, in clean cold water; and so prepare a liquor on purpose, by which the lilacs may be blued or reddened at pleasure. When this liquor is first mixed, it becomes of a green colour, the silks should not be dipped till the liquor begins to lose this green, and is inclining to the colour of blue. The pearl-ash added to this liquor, helps to blue the archil, because the effect of alkali upon red, is to render them violet.

Another Process for Silk Lilac.

This process is to use the chemic blue with the archil, according to the shade required.

Another Process for Muslin, &c. (Lilac.)

This is to mix the neutralized chemic blue for cotton, with the pink dye of carthamus or safflower, according to the shade required.

Silk Violet or Purple, with Logwood.

The silk should be alumed and washed. The logwood should be boiled in large quantities, like the fustic, that was directed for green, but should not be kept longer for this purpose than two or three weeks; it is far better used cold than hot.

Silk Violet, with Brazil Wood and Logwood.

The silk must be alumed and cooled as usual; it is then alumed and dyed in a liquor of Brazil wood, of the common heat, then in the cold logwood, and finally, a solution of pearl-ash is added to the liquor in which the silk was last dyed. It is afterwards washed and dried, but for some shades it is best to have fresh liquors, particularly for the warm Brazil, the cold logwood, and the solution of pearl-ash; in this case the quantity of each may be much better regulated.

Silk Violet or Purple, from Brazil Wood and Archil.

The silk, when alumed, is dyed in the decoction of Brazil wood, according to the shade required; then washed off, and then dyed in archil; it is afterwards washed a second time. After this it is dipped in the vat, and wrung and dried with the same accuracy used in greens and blues.

To dye Wool with Lac Dye, for Scarlet and Crimson.

From the East Indies there has been imported much of lac lake, and lac dye; the lac lake, is of very uncertain quality, having much resin, and other heterogeneous substances, and much sand mixed with it. The lac dye is superior; its various prices shew the difference of the value of it;

I have seen many samples of it from two shillings and upwards, to twenty shillings per pound.

This lac dye is much used for dying woollen yarn scarlet and crimson, for carpets and hearth rugs. It is used with a peculiar spirit, for the purpose, which may be purchased at the dry salters; or of Mr. Parke, chemist, Goswell-street road, and of Mr. Womersley, Osborn-place, Whitechapel; the better the lake, the more success there is in the dying; but I never saw any that would compare with cochineal, when the yarn dyed with one was contrasted by the side of the other.

The mode of using the lake dye is to have the lake ground, and put into a stone pan, (as has been observed), the quantity of lake must be proportioned to what is likely to be used, and stirred about by a glass rod or tobacco pipe stirrer; with a proportion of the above-named lake spirit, sufficient to make it about as fluid as treacle.

Some will use alum and tartar as a preparation, and some will not; after putting this mixture of lake and spirit in the copper, then add the goods, and work it at a boiling heat; for scarlet add American, or quercitron bark; for crimson add archil.

On Scouring and Dying Wool.

Wool is scoured with stale urine, the staler the better—it is used in proportion of three parts of water to one of urine, full as hot as the hand can bear when the wool is worked in the fluid. If the wool is in the fleece, what is called its natural yolk, which preserves the wool from the moth, and is of a greasy nature, is scoured out by the volatile alkali of the urine;—if it is spun yarn, it has Gallipoli oil, or rape oil imbibed in the thread, which the spinner uses to cause the wool to stick, and cohere together when breaking, carding, scribbling, throwing and spinning it into yarn. It is absolutely necessary that wool should be scoured very clean and white, to be dyed of any brilliant or bright colour. The wool is passed, two, three, and in some instances, four times through fresh scouring liquors; in the last, and sometimes in the two last, soap is used, in the proportion of seven to fourteen pounds, and in some instances to twenty-one pounds or more to the pack of two hundred and forty pounds of wool, according as it is fine or coarse; for superfine colours more than common is used.

Worsted requires less than coarse yarn, having less grease and dirt in it.

A Pastil, or Woad Vat, for Blue, from Hillot.

Take for experience, upon as small a scale as can be tried, a copper vessel of about 12 gallons, two thirds full of soft water, and one ounce of madder; place this small copper, immersed and fastened in a larger copper of water, so that the heat may be applied, to keep the liquor in the smaller copper of a proper heat or temperature; it is then in fact in a water bath. Having lighted the fire, add a good handful of bran, and five pounds of woad; at five o'clock in the evening, have it stirred and covered, and the heat about blood warm, and continue that heat as near as possible, so as not to be lower than summer heat, by the thermometer, nor higher by the same instrument than fever heat.

The vat, before well stirred and covered, should again be stirred at seven, at nine, and at twelve at night, at two in the morning, and at four. Hillot describing the process, observes, " The woad then working, some air bubbles began to rise pretty large, but few in number, and of a very faint colour; it had then two ounces of lime added, and was stirred; this was four o'clock in the morning; at five o'clock a pattern was put in, and at six o'clock the pattern was taken out, and the vat stirred. This pattern had received some colour.

At seven o'clock I put in another, and at eight stirred it again. This second pattern was tolerably bright. Then an ounce of prepared indigo was added; at nine o'clock another pattern; at ten stirred again, (taking the pattern out) and putting in an ounce of lime, because it began to smell sweetish; at eleven another pattern; and at twelve at noon stirred again; this process was continued until five o'clock in the evening; I then added three ounces of prepared indigo; at six I tried another pattern, and at seven stirred again; the last pattern that was taken out was of a very good green, and became a bright blue. One ounce of lime was added, to sustain it till nine o'clock next morning; patterns were put in from time to time; the last was very beautiful. The vat was filled up with water, and a small quantity of bran; it was then stirred, after that patterns were tried every hour till five o'clock in the evening; when being in a proper state, it was immediately worked. It had then some lime added to preserve it; it was stirred and left to another opportunity to re-heat.

The Manner of Preparing the Indigo for the Woad Vat, in Proportion to that of Hillot.

Boil for three quarters of an hour two ounces of potash, three quarters of an ounce of madder, and one ounce of bran, then let it settle half an hour; after it is all settled and taken out of the boiler, and is put into another copper, with four ounces of indigo finely ground, the liquor should be kept stirred, and very hot, but not boiled; and at intervals, some lixivium of lime should be put into it, and that being cold will keep the other from boiling, and render the potash more active. As soon as the indigo appears dissolved, and properly diluted, damp the fire and cover the solution; after it is settled, put in a pattern, which when taken out, will turn blue on being exposed to the air; if it does not, more clear lixivium must be added. Of this solution of indigo, those proportions are added to a woad vat, as were observed in the preceding process.

Rules to Judge of the State of the Woad Vat.

The vat is ready for working and to dye blue when the sediment or grounds at the bottom are of a fine brown green, when it changes upon taking out of the vat. When the froth which rises in great bubbles on the surface, is of a fine Prussian blue, and when the pattern that has been steeped an hour, comes out a dark grass green colour, and changes in the air to a blue; when the liquor is clear and reddish, and the drops which stick to the rake, brown; when the sediment or grounds change colour on being taken out of the brevet or liquor, and become brown on exposure to the open air; when the liquor is neither harsh nor greasy to the feel, and neither smells of lime nor of lixivium, then the vat is known to be in a proper state for working.

Indications, when a Vat has suffered by too much or too little Lime.

These are two extremes, which ought carefully to be avoided; and I shall give directions how they may be remedied.

When the lime has been deficient, or a pattern comes out a dirty grey blue, and the sediment does not change its colour, there is scarcely any effervescence on the vat; the liquor smells only of lime, or of the lixivium of lime.

To Remedy the Deficiency of Lime.

If the vat is not too far gone after the addition of a little bran, madder, and some woad, then try the patterns from hour to hour; by these operations you will be able to judge.

A deficiency of lime is evident when there is no effervescence on the liquor; and when by dashing the surface of the liquor, it makes a hissing noise; and by the bursting of a number of small air bubbles; as soon as they are formed, these small bubbles when they break appear tarnished, and not large air bubbles of a fine blue colour; the liquor has also an offensive smell, like rotten eggs. The liquor is harsh and dry to the feel, and the sediment does not change colour, when taken out of the liquor.

When these effects have proceeded too far, it is impossible to remedy the disease of the vat; but when not gone too far, sprinkle some lime into the liquor, and stir it. If you can thus cure the liquor, and bring it to smell of lime, and to feel soft, cover the vat and let it stand. If at the expiration of an hour and a half, the effervescence commences, you may put in a pattern, which in an hour afterwards you may take out, and regulate your process according to the degree of green which the pattern has imbibed; but in general, when vats are in this degree out of order, they are not so soon recovered.

How to work a Vat that is in proper Order.

The vat being in this state, the cross suspended, and thirty ells of cloth ready, or scoured wool in proportion, designed for black by dying of it a blue grey; and having passed and repassed this cloth through the liquor a full half hour, it is wound round the winch, and thrown off into the barrow, and aired by the listings to change the green to blue. Even after this a second piece may be done by the same process. Having made this overture, which is likewise called the first stirring, you stir the vat afresh, adding lime; but not so much as to destroy the proper smell and feel. If the vat be in a good state on the first day, it may be stirred three or four times: it must not be overworked, particularly on the second day. Concerning the colours to be obtained to the best possible advantage, from a fresh vat on the first day,—the first is for black, the next for royal blue, and the third a brown green. Then on the second day the violet, purple, and Turkey blues, in the last stirring. On the third day if the liquor is too much diminished, it must be filled up with hot water. At the end of the week the light blues may be done, and on Saturday night add rather more lime, to preserve the vat till Monday morning. On Monday morning add more indigo, and stir the paste; keep the vat liquor at a proper distance from the top. Cover it for two hours; then put in a pattern, and in an hour take it out; add lime according to the green shade of the pattern, and at the expiration of an hour or two, if your vat has not suffered, you may venture to commence working it afresh.

To keep the cloth, &c. from the grounds, there is always let down into the vat before the work commences, an iron circle, with cords fastened from the circumference to the centre.

Method of Dying Blue.

Whether the goods be cloth or skeins of yarn, they must in all cases be wetted out and wrung, and then put into the vat; worked in it, taken out and aired, that they may turn from green to blue, and if necessary be put in again.

There is no difficulty in dying dark blues, by repeated dippings; but if light blues are dyed in the vats that are nearly exhausted, they will not be bright.

Blue vats upon a large scale are now mostly heated by steam, they are then with little trouble always in a state fit for working, without the necessity of re-heating. They are very convenient for light colours, even after they become very weak. In some instances, in order to dye light colours to the best advantage, it would be advisable to set a vat on purpose, that should be strong in woad and weak in indigo; because the colour would be given more slowly, and the light colours obtained from them with much more facility.

CHAPTER IV.

On Dying Crimson upon Worsted Yarn.

PROPORTIONS of wool,	one pound.
Of alum, - - - - - - - - -	two ounces and a half.
Of white tartar, pounded,	one ounce and a half.

Having the water properly cleared by bran, the scum taken off, and the worsted wetted out, let the alum and tartar be boiled; when it has commenced boiling, stir it well, and put in the worsted, and boil it in the alum and tartar for two hours; then prepare a fresh liquor for the cochineal, and for every pound of wool, put in one ounce of cochineal; when it begins to boil, stir it well, and put in the worsted, and boil it till the liquor in the vessel is free from colour, having parted with the cochineal, which should now all be upon, and in the body of the worsted. If a series of shades are required, less proportions of cochineal, alum, and tartar are used, and the lightest shade is dyed first.

The Preparation of Archil to finish the Crimson.

Put as much archil as the proportion of goods require, as it respects both the quantity of cloth and worsted; and the fulness or lightness of the shades of crimson required. Put this archil into a copper of water corresponding in size, and boil it, (the best canary archil will bear boiling), damp the fire, let the archil settle, and then have a fresh liquor for the goods to be put in, to receive a proportion of archil according to the pattern desired to be matched. Begin with the lightest, and end with the fullest, reserving the remains of the archil liquor if it is not all spent, for common compound colours of such shades as it will be advantageous to use it in.

On dying Scarlet.

Scarlet owes its beauty to a solution of tin. Muriatic acid or spirit of salt is the true dissolvent of tin; some use sal-ammoniac, some sea salt; the first is a spirit of salt united to a volatile alkali. It is of little consequence whether salt or sal ammoniac is used; many different preparations are employed by different people. I have found the following answer every expectation: block tin, or rather grain tin, one ounce, melted and dropped from a heighth into water; the water poured off, and the tin put into a glass vessel or stone jar, and then add to it eight ounces of nitric acid, or aqua fortis, eight ounces of water half an ounce of sal-ammoniac, and two drams of salt-petre. This preparation is better when made some time before it is used. In a copper of cleared and boiling water, reducing the heat, and having the worsted wetted out ready, for every pound of which (dry) put two ounces of cream of tartar or white tartar pounded, and one dram and a half of cochineal. The cochineal must be ground; when the liquor is ready to boil, add two ounces and a half of the composition or solution of tin, which immediately changes the colour of the liquor: stir it well; as soon as the liquor begins to boil put in the worsted, and boil it till the colour of the cochineal is taken up by the worsted. The worsted must be taken out, and it will be of a flesh colour; and the water in the copper will be like common water, and almost as clear. To finish the worsted, a fresh clear water is got ready, and when it gets warm, six drams and a half of cochineal is put in, and a little before it boils two ounces of the composition, which, when well stirred, will cause the colour of the liquor to change as before. The worsted is then put in and again boiled, till it has imbibed the colour; it is then taken out, wrung and rinced in clean water, when the scarlet is in perfection.

One ounce of cochineal to a pound of wool, will give it a fine colour, and make it sufficiently deep, provided it be managed with attention, according to these rules, and no colour left remaining in the liquor.

For many shades of scarlet it will be necessary at last, and in a fresh liquor, to add either a certain proportion of turmeric or young fustic, to give the scarlet that proportion of fiery red, which some of them possess, if not in an entire fresh liquor; part of the liquor must be taken out before the yellow is added.

When you wish to dye a regular series of scarlet shades in worsted, half the quantity or less for some of the lightest will be sufficient of the tin preparation, tartar, cochineal, &c. The worsted should be separated into divisions corresponding with the various shades required; the lightest is done first; if you perceive any deficiency in the shades, that shade or shades may have another dip. This deficiency is easily perceived, and a very little practice will enable the operator to sort them perfectly. I have to observe that the vessel the most proper to die scarlet in, should be made of block tin, such as are used by all the scarlet dyers for the East India Company.

When cloth is desired to be dyed scarlet, you put for every hundred pounds of cloth, six pounds of tartar, and eighteen pounds of the composition, into the preparation; at first the same quantity in the completion, and in each operation six pounds and a quarter of cochineal. For the accommodation of those who would make small experiments, the whole may be reduced, viz. one ounce of cream of tartar, six ounces of composition, and an ounce of cochineal for every pound of worsted, &c. putting two thirds of the composition and tartar, and a quarter of the cochineal into the preparation, and the remainder to the composition. *Vide Hillot.*

On dying Wool Maroon.

Worsted or yarn must be boiled in one-twelfth of its weight of alum; the same quantity of white argol, and the boiling continued for an hour or two. It is best when there is a large quantity of yarn to do this on the preceding day; if your copper holds a pack of two hundred and forty pounds, it will be cold enough to handle, after remaining with the fire out during the night; when the skeins &c. are to be taken out and righted, and put upon poles or sticks, then have a fresh water ready in the copper, in which put about thirty pounds of chipped peach-wood, and when it has boiled half an hour, pour in some water to cool down with, and add fifteen pounds of grape madder; work the woollen yarn in this liquor rather under a boiling heat. When it is full enough, for some shades you add some archil, and as the two hundred and forty pounds are dyed at four or five turnings in, some of the quantity might be varied, in the hues, instead of confining the whole work to one shade. The various turnings in will take the greater part of a day to perform; when you choose to have as many shades as there are turnings in, you divide the drugs into different portions at different periods of the time, to spend them according to the patterns required; and as the most economical mode of spending the drugs is to follow the patterns one after the other, practice will teach the operator to do this to the best advantage. More madder than peach-wood, gives a lively red; more peach-wood than madder gives a bright maroon red, bordering on crimson, but more so without any madder, and with the addition of archil, it gives a crimson; but by no means to be compared with the crimson of cochineal. Urine with the archil saves a portion of archil.

On dying Wool yellow.

The proportions of alum is by various dyers from one-fourth down to one-twelfth of alum for every pound of cloth, and of tartar one-sixteenth to a pound. For worsted and yarn they are from a twelfth to a tenth of alum and argol or tartar, that is, alum and argol of equal quantities, from a tenth to a twelfth of the quantity of worsted or yarn. Such are the various proportions for the preparations. The shades of yellow are straw yellow, pale yellow, lemon yellow, and full yellow.

When the woollen cloth or yarn has received its preparation of alum and tartar, according to what is allotted to the shade, whether light or full, for which it should boil in the preparation of alum and argol at least one hour, and two hours for full yellow, then a fresh liquor is to be made to receive the weld, which is previously boiled; and for a full yellow four to five pounds of weld will be required to one of cloth or worsted; for the lighter shades less in proportion; but the weld should be boiled and reboiled a sufficient quantity, and no more, for it will not keep but a very little while after boiling. If you have a succession of shades, you will save drugs and expence, by doing the fullest shades first, and the lightest last, to spend the drugs to the best advantage; but the lightest this way will not be so bright, as if you were to do the lightest first, and refresh the liquor with fresh boiled weld, and so on to the fullest shade. At last you must have for the goods a preparation weak or strong, according to the light or full colour they are to be of. The last dying, whether of cloth, yarn, or worsted, will be sure of taking all the colour out of the dye, of any consequence or excellence of colour and brightness. Where expense is not the object, not only for yellows, but for all other colours, it is best to have the preparation and the dye proportioned to the shade, the colour done at once, and the spent liquor remaining thrown away. But as the general price paid for dying will not enable the dyer so to act, he must commonly do his shades as above in succession, with the utmost economy, and keep his expences as low as possible.

On dying Wool brown or fawn Colour.

These shades are extremely various, and are performed without any preparation, with alder, bark, red sanders, shumac, galls, madder, &c. and under a boiling heat, though it may be necessary to boil some of the ingredients together previous to the dying; for instance, the red sanders will give its colour best when boiled with galls, alder bark, shumac, &c. Cam wood, bar wood, walnut rinds, roots, &c. are used in some of these shades, the variety of which are almost infinite. Practice is required in this branch of dying equal to, or beyond any other.

On dying Wool Purple, &c.

Pass the goods through archil, next through the blue vat, with the usual precautions; then pass them through hot water. For some shades you alum, and then dye them with cochineal for the crimson part of the purple; as blue and crimson make purple, violet, &c. according to the various shades of patterns required.

On dying Wool Green.

The shades are very various, viz. yellow green, pale green, bright green, grass green, laurel green, olive green, sea green, parrot green, cabbage green, and duck's wing green.

The woollen goods have first a blue ground from the woad vat, light or full according to the pattern, and then they have a preparation afterward of alum and tartar, weak or strong, according to the lightness or fulness of the pattern; and afterwards are dyed in weld liquor to receive the yellow part of the dye. Many of these shades are more readily done by dying the wool first yellow with old fustic, with preparation of alum and tartar, and using the chemic blue vat, made with oil of vitriol and indigo.

Chemic Vat for Green Woollen.

Prepare in the same manner as described for cotton, eight ounces of indigo, and four pounds of oil of vitriol. This preparation of indigo will not be required to be neutralized for wool, as described for cotton: in some instances the preparation is to be for the yellow of fustic, one-twelfth of alum, the same quantity of tartar, and, in some instances, one-twelfth of alum only.

Chemic Vat for Blue Woollen.

This is to be made the same as for green, without any necessity of putting any alkali to its acid, as is the case in the cotton; but for blue, there should be twelve ounces of indigo to four pounds of oil of vitriol. In dying, the heat must not be too high, but much under a boiling heat, or else the blue would incline to green. This blue colour wants no preparation; it is very bright, but not fast, and no preparation is of any advantage to its fastness or brightness. Some put alum and tartar, some use one, some the other, to prevent a green cast. If the wool is fine, white, and worked much below boiling, it will not green, although neither are used.

On Dying Wool Orange, Gold Colour, &c.

The process of crimson, scarlet, and of yellow united, produces the various shades of these colours (leaving archil out). *See Buff, Peach, &c. on Wool.*

On Dying Wool Black.

Black includes a prodigious number of shades, beginning from the lightest grey, or pearl colour, to black. On account of these shades it is ranked among the primitive colours, for the greatest number of browns, of whatsoever shade they be, are finished in the same dye as would dye white wool a grey, more or less dark. This operation is called browning. The best superfine black should have a full ground of Mazarine blue previous to its being finished black.

It is necessary to premise, that a great quantity of cloth and other articles dyed black have no indigo ground, but a ground of logwood, or of logwood and alder bark, or logwood and old fustic, or logwood, alder bark, and old fustic, all boiled together, and sometimes boiled in a liquor of oak saw-dust, or decoction of oak saw-dust.

Indigo for the ground is the richest drug of any that is or can be used; rich, I mean, in carbon, logwood is next to it. Too much logwood, whether indigo is used with it or not, would make the black have a foxy hue, through the copperas that is used, acting upon the astringency of the logwood or its gallic acid, as it has a portion of the same acid as galls: the alder bark and old fustic modify these effects, and are used in small proportions for that purpose, because what rises from them, as well as the oak saw-dust, will go to a soot or dead black. A jet black is required, full and rich; therefore, old fustic and oak sawdust is only used to modify the richness of the ground, as it regards the blue, either of indigo or logwood; for logwood especially, without them, if overcome with shumac and copperas only, would be foxy, purply, or have a reddish cast.

So many different grounds being used for blacks, and as each dyer thinks his own the best, this occasions such a great variety of hues, even of blacks in the market. I have, therefore, thought it unnecessary to describe the various modes of dying black practised by different dyers, and which, in fact, would be impossible. But I have done what is of much greater importance to a young student in dying, who, after a little practice, let him have a pattern of black to dye, will know how to go about it, let who may have dyed it.

" Even a blue ground is, according to some, dyed afterwards in a decoction of logwood and galls, or logwood and shumac, and two pounds of verdigris for a hundred pounds of cloth. Thus ten pounds of logwood and ten of galls are to form the decoction, and are boiled previously for twelve hours. One-third of it, with the verdigris, is used first, and then the cloth is aired, after boiling in it for two hours; then passed through one-third more of the decoction of logwood and galls, having eight pounds of copperas melted in it first, and scummed. The goods are to be worked in this one hour at boiling heat; then aired again, turning them about upon a stone floor. The rest of the decoction of logwood and galls is then added with fifteen or twenty pounds of shumac; boil it some time, and add five pounds of copperas; scum it, and cool down; then put the goods in, and work them at a boiling heat an hour or two, taking them out once or twice at least in the time, to air and cool, then they are to be well washed; then pass the goods through a decoction of weld liquor, to soften the black, and it will be a very fine black." This process is chiefly from Hillot. I have put in three pounds more copperas than he appointed. I doubt not but it would be a good black: though, as he observes, for the most part, so much pains is not taken; but, when the cloth is blue, it is boiled two hours in nut galls, washed and aired, and then some copperas and logwood are added to the liquor, and the goods worked in it for two hours, and washed The above has been the practice for a century past in France, where galls were not then so dear in proportion as they are now in England; so that shumac here is now most commonly used as a substitute for galls.

Another Process for Black, from Heigh, without a Blue Ground.

Take cloth, one hundred weight; thirty pounds of chipped logwood; a large pail full, or say half a bushel of alder bark, and six pounds of shumac, boiled together for half an hour; then cool down with cold water, enter the cloth, turning it on the winch, bring it to a boil (having the shumac in a bag), boil and keep the cloth turning one hour and a half: this is the ground. Have ready fourteen pounds of copperas melted. This melted copperas is to be laded into the copper by one man, while another turns the cloth for an hour at a boiling heat; it is then taken out, cooled and aired, returned into the copper, and boiled gently for two hours, and then cooled again. While the cloth is cooling, six pounds of logwood, ten pounds of alder bark, two pounds argol, ten of soda, or common ashes, and three pounds of copperas, are to be added to the liquor in the copper, and boiled one hour, when the goods must be turned and worked one hour; and lastly taken out and aired. This black is said to be of the hue of a raven's feather, according to Hellot.

The argol is professed to be put in to counteract the vitriolic acid of the copperas: the alkaline power of the ashes is said to cause the logwood to retain its natural violet colour; and if too great a quantity of logwood is not used, the result would be as above stated. I presume this black would not at this time be much esteemed. I object to the introduction of so much, or indeed of any alkali or argol, as the time employed to perform this process is lost. Alkali is good to put in where a chemic green is dyed black.

Wool will take up whatever the copper contains necessary to dye black; but, for the beauty of the colour, and the durability of the cloth, it is best to let it have most of its ground of vegetable colour before it has the copperas (or sulphate of iron) which blackens that ground, with shumac instead of galls; and, in some instances, in dying some goods without shumac.

Were I to choose a black cloth, dyed as I would have it, I would have an indigo ground, with logwood and alder bark, without old fustic or oak sawdust; and, to finish it, shumac, copperas, and a small quantity of verdigris. I would give it the blue ground first; then the logwood, alder bark, and verdigris; and then finish it with shumac and copperas.

If I was to leave out the blue ground, then I should dye it at twice; giving it more of logwood and alder bark, verdigris the same; and finish it with shumac and copperas: but if I have to dye to pattern, then I must be guided by that pattern.

Different goods will want a different proportion of drugs, from about one-fourth of the weight of logwood to the goods to be dyed: the copperas must be one-fifth of the logwood; alder bark, where it is used, about as much as of copperas, though in some of the common yarns it is not used, or is not necessary, and where fustic or oak sawdust is used, there will be the less necessity for using alder bark. The shumac must be about the same proportion as copperas. Remember it is the carbon that makes the dye rich. It is the iron of the copperas, with the astringent or gallic acid of shumac and logwood, that blackens the dye.

The way to ascertain when your proportions of drugs are most appropriate to produce the most desired effect, is as follows:

First, ground with various proportions of drugs, from three to five or seven patterns, in quantities sufficient, according to the quantity or magnitude of the work you are likely to do, using from one-third to one-fifth of the copperas and shumac to the grounding; afterwards finish with the remainder of the copperas and shumac: the fuller your ground the richer your black, if your logwood is not in excess, and your proportions are any ways calculated within a nearness of what I have stated.

CHAP. V.

To dye Wool Grey.

GREYS are shades of the black from the darkest to the lightest; they are of great use in the art of dying, for their own colours simply, as well as when applied to other colours, which is called saddening or darkening.

Some greys have a woaded ground of blue, then of logwood, shumac, and copperas, which liquors or decoctions of logwood, shumac, or copperas, for the sake of expedition, should be in readiness when they are wanted. When a succession of light shades in particular are required, in some instances the chemic blue is used; but when we come to speak of the mixture of black, or rather of grey with red and blue, we shall see the utility of the grey.

Mixture of Black or Grey with Red and Blue.

These produce an infinite number of all shades of grey, as sage grey, slate and lead colour, and others still darker.

On Brown Fawns, Greys, &c.

The browns and fawn colours I conceive to have iron in them, as a component part of their body. I believe chemists have ascertained the fact, and that iron is also in the blood of the human body. It is well known that many waters hold iron in solution, and it is further supposed that iron is formed by the decomposition of animal and vegetable bodies, under circumstances particularly favourable, in the body of the earth. If so, as I believe it very probable, it is no wonder that blue, red, and fawn, produce olives from the darkest to the lightest; likewise slate and lavender, when the shade of red is very light.

The fawn and yellow produce the fille-mort or dead leaf.

Fawn and red produce cinnamon, tobacco, chesnut, &c.

Fawn colour and black produce coffee, maroon, &c.

Blue, yellow, and fawn produce greens and olives of all kinds.

Blue, yellow, and black produce all the dark greens, even to black.

Blue, fawn, and black produce dark olives and greenish greys.

Red, yellow, and fawn produce orange colour, gold colour, withered leaf, carnation, burnt cinnamon, and tobacco colours of all kinds.

Yellow, fawn, and black produce hair colours, nut-brown, &c.

This enumeration is meant only to give a general idea of the ingredients proper for the production of shades composed of several colours compounded. The yarn or worsted for the modern carpets, or hearth rugs, have superseded the ancient tapestry.—Where red forms a component part of the colour desired, the goods must have a preparation of alum and argol, strong or weak according to the fulness or weakness of the red, which forms a component part of the compound dye, such as the half or quarter of the quantity required for a full colour of red; the same as to yellow, and in proportion when red and yellow are joined.

Of the Yellow of the American Bark.

The botanical name of this bark is *quer citron*, or the *quercus migra* of Linnæus. It is said to yield from eight to ten times more colour than the Weld, and about four times the colour of old fustic; such, however, is Bancroft's account, who was a Doctor of Medicine, and a considerable proficient in the science of botany. He also asserts that one pound of bark with muriate of tin, will dye forty pounds of woollen a bright golden yellow, which afterwards becomes a beautiful and durable scarlet, with a fourth part less cochineal than usual. But Bancroft did not succeed in his expectations of doing away the old method of saving tartar and cochineal. I have not tried his process, and therefore will not say it failed absolutely, as, in his two volumes lately published, he still insists, under certain circumstances, that his way was the most brilliant by candlelight; and the bark more durable than turmeric or young fustic, even if tartar was used; which he seemed to think rendered the colour more solid, full, and brilliant.

For his fullest yellow upon cloth, he gives the following process, which I have often tried, and certainly found it to produce a rich golden yellow: cloth, an hundred pounds; bark, in powder and in a bag, ten pounds; muriate tin, or muriosulphate-tin, ten pounds; the bark in the bag is first immersed in the proper sized vessel, for six or eight minutes; then add the solution of tin, and stir it well for two or three minutes; then the cloth must be put in, and kept in motion by two or three men working it over the winch from end to end; then proceed to boil, and in fifteen minutes boiling the highest yellow is produced; a longer time would tend to brown the yellow. When a very bright yellow, approaching less to the orange, is wanted, seven or eight pounds of solution of tin, five pounds of alum, and ten pounds of bark, will do for a hundred pounds of cloth. In this process, boil the bark first in a bag a few minutes, then add the tin and alum, and the cloth afterwards, as before directed; less body requires less proportions.

For a full bright Yellow, delicately inclining to the greenish Cast or Tinge.

Use eight pounds of bark to six of muriate of tin, six pounds of alum, and four pounds of white tartar, for cloth as before. The alum and tartar render the yellow more delicate, and give it more of the lemon and greenish tinge; and where this is wanted in the greatest perfection, proceed according to the following process: ten pounds of bark, ten of muriate of tin, or murio-sulphate of tin, ten ditto of alum, and ten of tartar. For cloth, three or four times the quantity of the other processes may be taken, that is, from three to four hundred pounds.

In this process the bark is to be boiled first fifteen minutes in water only, and then the other ingredients added, and mixed in the liquor by stirring. The cloth is afterwards to be put into the liquor *(the liquor being first cooled a little)*. Then the cloth is directly turned briskly on the winch, till the colour appears to be sufficiently raised. Where a variety of shades are desired, in working the bark (which is contrary to many other colours), the higher shades should always be dyed first, and the weaker afterwards; when about two-thirds of the quantity of the cloth has been dyed, it will be generally found, that the liquor, by continuing to extract colouring particles from the bark, has acquired an over proportion of bark, and wants a small proportion of muriate of tin, alum, and tartar, perhaps a pound of each, to enable the bark at last, as well as at first, to give the same a delicately pale, though greenish tinge; and indeed a surer way is to boil the bark in a small proportion of water separately, for the space of six or eight minutes; then add to this bark the solution of tin, alum, and tartar, and boil them with the bark, altogether for fifteen minutes, and damp the fire; then have the cloth in another proportionably proper vessel, supplied with boiling water, and the cloth moving on the winch, after it has gone a few turns and thoroughly wetted out, which it should be before, and now again, lest any part should be dry again; then add the supplies of the yellow liquor, above described at first, by a little at a time, and as it may be wanted; in this way expectation is surpassed by the beauty produced.

Bancroft makes his murio-sulphate of tin thus:

—muriatic acid three pounds, the strength of the acid, supposing pure water, one thousand; then the muriatic acid one thousand and seventy: the tin, viz. grain tin, is to be melted in an iron ladle, and poured from an heigh into a pan or pail of clean water; take out the tin, and to this tin add gradually the three pounds of muriatic acid; afterwards, with due and great precaution, by degrees in the course of a day or two, two pounds of sulphuric acid or pure oil of vitriol. The vessel had better be true or genuine stone ware, bought of the potter, or at least of those who understand the ware; that being glazed with sea salt and not with lead, as the common earthenware is; the lead would be pernicious. I have mentioned these circumstances before, but as they are of particular importance, I chose to venture a few repetitions in this case rather than give the reader the trouble of reference. But at all times, when the strong agents of acid and alkali are employed, in their concentrated purity, we must use either the vessels described above, or glass.

To dye Wool Buff.

This is done with the best economy after scarlet, in that case requiring but a very little addition, and in some cases none, of cochineal; the wool having an alum preparation, it may be requisite to add some decoction, fresh prepared, of young fustic or weld.

To dye Wool Peach.

This process is the same as the above, that is, after the scarlet; but the wool not alumed, and, in some cases, a little tartar and cochineal is added.

N. B. The cochineal and tartar being added, the previous preparation must be according to the fullness or faintness of the shade required of buff, peach, or flesh, which is of the same modification in its process. By these means you may do a pattern to any shade compounded of red or yellow, from the scarlet to the weakest buff and flesh.

To set an Indigo Vat, from Hellot, for Worsted Serge, &c.

Suppose the size of the vat five feet high, and two feet in diameter at top, you may use from two to six pounds of indigo in such a vat as this, according as you set it light or full.

Boil in fifteen gallons of clear soft water in a copper, for half an hour, two pounds of potash, two ounces of madder, and a handful of bran.

The indigo is to be ground; after that it must be levigated in a peculiar mill, of cast iron, circular, with a contrivance for two large round stones or cast iron balls, which balls are kept in a perpetual circular motion, and the indigo ground. Water is put into this circular pot or mill with the indigo, and as the balls run round, the indigo in the water is reduced to a fine flowery paste. There are mills more convenient than these, but perhaps none more simple for a small concern.

When the indigo is first ground dry in the common indigo mill, and afterwards ground wet, as above described, you put the liquor in, and boil it in the copper with the grounds of the madder and potash, which fell to the bottom; it is all to be put into the vat at the same time as the indigo, the whole is then to be stirred, the vat covered, and heat put to it, to make it more than blood warm, and to keep it so. The vats should be stirred twice slightly, both the second and third day; the heat remaining the same. You will then perceive, that a brassy scum, divided and interrupted in many places, begins to rise on the surface. The heat being continued the fourth day, the scum becomes more perfect and less broken; the froth that rises upon stirring is more blue, and the vat of a deep green.

When it becomes green in this manner, it is an indication that it must be filled, to do which, you boil for a quarter of an hour half an ounce of madder, and one pound of potash, in five gallons of water; put this in, and stir it; and if it produces much froth stir it again, and the next day it will be fit for working; this will be sufficiently known by the quantity of froth, and by the brassy and scaly crust that swims at the top of the liquor. By blowing or stirring it, the liquor beneath is green, though the surface appears of a brown blue.

When this vat has worked about forty or fifty pounds of serge or worsted, it may be necessary to replenish it with one pound of potash, half an ounce of madder, and a handful of bran; these being boiled for a quarter of an hour, are added to the vat.

When this vat wants replenishing with indigo, which may be known by the liquor being no longer green, but brown, blue, and almost black, you put two-thirds of this liquor into a copper. When ready to boil, the scum upon the top is taken off with a sieve, after which it should be suffered to boil, with the addition of two handfuls of bran, a quarter of a pound of madder, and two pounds of potash; soon after it has boiled it is to be emptied out of the copper into the vat, with one pound of indigo prepared as before; the vat being again stirred and covered, and the heat always remaining between blood heat and fever heat.

When an indigo vat has been reheated several times, it should be emptied out entirely and set anew, because the colour becomes dull.

CHAP. VI.

On dying Silk Black, according to M. Macquer.

Black, he observes, is rather a difficult dye upon silk; or we have at least reason to think so, considering the numberless experiments and inquiries that have been found necessary in the attainment of a good black, if we are to judge from the multitude of ingredients that are admitted into the composition of this colour, as for instance:—

First.

20 qts.	of strong vinegar,
1 lb.	black nutgalls pounded,
5 lbs.	iron filings.

The above ingredients are mixed in one vessel.

Second.

Other drugs to accompany the vinegar, galls, and iron, viz.

8 lbs. black nutgalls,
8 lbs. cummin,
4 lbs. shumac,
12 lbs. pomegranate rind,
4 lbs. of bitter apple,
3 lbs. agaric,
2 lbs. of Coque de Levant,
10 lbs. of buckthorn,
6 lbs. of linseed,
20 lbs. logwood.

These are all boiled, settled, the clear liquor drawn off, and the mixture of vinegar, iron, and galls added.

Third—Another composition.

20 lbs. gum Senegal,
3 lbs. red arsenic,
1 lb. sal ammoniac,
1 lb. sal gem
1 lb. mineral crystal,
1 lb. of white arsenic,
1 lb. corrosive sublimate,
2 lbs. green copperas,
2 lbs. skim of sugar candy,
10 lbs. powder sugar,
4 lbs. litharge.
5 lbs. antimony,
2 lbs. orpiment,
2 lbs. plumbago.

These several drugs must be pounded and

sifted, except the gum, which is previously dissolved and strained.

These drugs are all added to the preceding in the copper.

Fourth.

2 lbs. black nutgalls pounded,
4 lbs. shumac,
4 lbs. cummin,
5 lbs. buckthorn berries,
6 lbs. pomegranate rinds,
1 lb. bitter apple,
2 lbs. agaric,
2 lbs. Coque de Levant,
5 lbs. linseed.

Fifth.

8 ozs. litharge pounded,
8 ozs. antimony,
8 ozs. plumb de mer,
8 ozs. white arsenic,
8 ozs. mineral crystal,
8 ozs. rock salt,
8 ozs. fenugreek,
8 ozs. corrosive sublimate,
8 lbs. copperas,
20 lbs. gum Senegal.

Then separate
2 lbs. verdigris,
6 qts. vinegar, and
1 oz. cream tartar,
Boiled for an hour.

Sixth.

For every pound of silk you must have one pound and a half mixed (black and white) galls, pounded and boiled for two hours.

I shall not proceed to give this process throughout, as I am sure the present state of chemical knowledge would reprobate the absurdity of their composition, and the unnecessary expense of the useless, and, in some instances, the counteracting items, of these heterogeneous compounds. Macquer observes, it is reasonable to suppose that several of them are useless, and demonstrates this by a comparison with the following process for Genoa black.

Skein Silk Black for Velvets—Genoa Process.

To ungum the silk it should boil for four hours, with a quarter of its weight of white Marseilles soap, and be well washed out of the soap.

For every hundred pounds of silk,

20 lbs. Aleppo galls, pounded to powder, and boiled one hour,
2 lbs. copperas, or sulphate of iron,
12 lbs. iron filings,
20 lbs. gum.

This process is very simple. Here is the astringency of the galls, the iron of the copperas, and filings of iron; the carbon of the galls is as concentrated as in almost any vegetable body whatever.

Black for Silk—London Process.

Wove silk sarcenet twilled, one hundred and fifty yards.

1 bushel and a half alder bark,
14 lbs. logwood, and
1½ lb. iron filings.

These are boiled for three hours.

Let the fire be damped; melt a quarter of a pound of sulphate of copper or blue vitriol, then wet out the silk in hot water, afterwards put in the solution of blue vitriol, and stir the fluid only, and then put the silk into the copper and work it from end to end four times; then take it out and air it; then put it in again and work it as before, and take it out again and have it aired on the floor, opening it from time to time till it is cold; then repeat the same thing twice more, in all four times; this is termed four wets: while the last wet is cooling and airing, melt and put into the copper three pounds of copperas, and then give the silks two more wets, which brings them to six wets, and then the drugs are to boil as much as they will during the night, being left so to do, because upon a large extent of business, this would close the day's work. Then in the morning give the silks four or five wets more, and leave them in the copper all the following night, observing when they are left in, and always when they are worked in, that the heat must be considerably under the boiling point, and the silks kept covered by the fluid, which they will be where properly put in, without air; if any part is exposed to air it will be marked.

On dying Cotton Black at Rouen, in France, according to M. Le Pileur D'Apligny.

Take an hundred quarts of sour wine, bad vinegar, or small beer, put to either of these liquors twenty-five pounds of old iron hoops rusted by the air or dew, twelve pounds of rye meal or coarse bran; put the whole into a copper, and heat it something more than blood warm; in the summer it would do exposed to the sun and air, with a porous cloth over it, to let in the air, and keep out dirt, &c.; the older these ingredients are the better, but they should at least be two months old.

Cotton skeins are galled, by being worked in a solution of galls; alumed, then dyed in weld liquor; this, in the result, is yellow: they are then passed through a decoction of logwood, and after that of blue vitriol, a quarter of a pound to every pound of the substance; it is then dyed in madder, half a pound to a pound of the cotton. Here the process is finished, according to D'Apligny; but this would by no means be a black, and I suppose the translator of the work of M. D'Apligny should have stated copperas or sulphate of iron instead of blue vitriol.

On dying Cotton Black, being the London Process, and used by sundry Calico Printers in its Neighbourhood.

Cotton cambric piece goods are passed through a blotching machine, to receive a base or mordant of acetate of iron, and galled slightly, when galls are cheap (shumac is substituted when galls are dear); then passed through logwood, or logwood and fustic, and then through shumac; so that it is possible thus to give them their base or mordant sufficiently in proportion to the iron liquor at first; proceed as in dying, afterwards at a heat approaching boiling, or at boiling. You may now proceed by adding, first, the galling or shumac slightly ; afterwards the logwood, &c. and then the remainder of galling or shumac may be used to finish; and thus dye them black by the quickest process possible.

Respecting the last process, and of the process that preceded it, I must remark, that in dying black, alum is inimical to the colour. Therefore, D'Apligny's process is not what would be esteemed in the present day. Alum for black is as inconsistent, as it is proper and essential for red or yellow.

In respect to the process of giving the acetate of iron its base or mordant for black at once, as the second or London process points out, it may be done by having the proportions full; where I say full, I mean to be sure to have the base full enough; then after the slight galling recommended, I should, in giving the logwood and alder bark decoction, or logwood and fustic, be sure to have that decoction strong enough. This I should call the ground; and the most perfect judgment might be formed of it, by having a part of a piece, or one piece of a batch, dried in the stove: for according to the fulness of the ground, so would the black be rich and perfect, or otherwise. The alder bark and fustic are used only to prevent the logwood's hue from being predominant; and if the ground is full and rich brown, the second full galling or shumacking will bring it to a proportionate full and rich black; but if the ground is poor, the galling or shumacking will cut or destroy the ground, and the black will be foxy, rusty, and poor; and not only so, but the material died will wear rotten soon, because having an over proportion of iron, the iron will tend to decompose the cotton. Therefore the process most esteemed for dying, particularly cotton velvets at Manchester, is as follows:

In a large dye-house, where much business is done, a great many wine pipes, or other large tubs, or any substitutes, are arranged in an appropriate place. Into these are put old iron hoops, rusted in the air, and cut into short pieces; a layer of the iron pieces, and a layer of alder bark, then a layer of iron and a layer of alder bark, and so on in succession from bottom to top; when these are all full as they can be of iron and alder bark, water is poured into them, till they are filled up, and they are left to incorporate for six weeks or two months, according to the season of the year, whether summer or winter.

The same process that does for velvets will do for any other cotton goods, such as calicoes, cambric muslins, jaconets, or cotton in the skein.

In some instances there are persons who pass the goods in the liquor of the aforesaid black vat, viz. the iron liquor; which when it is fit to use becomes of a purply colour, particularly after it has been once used and returned into the tub again, which it always is. Others begin by passing the goods through a decoction of logwood and shumac, then through copperas, then wash off through logwood only, then through copperas, always washing off from the copperas; they are then dried, and this is called the first time of saddening.

They are then passed through logwood, then copperas, washed off, then again through logwood, then copperas, then washed off; and this is called the second time of saddening. They are then dried.

Supposing the goods to consist of a hundred or a thousand pieces, after drying the second time they are brought in lots by the labourers to the foreman for his examination, and he sorts them into lot 1, 2, and 3; all that is fit for lot 1, is full enough, and has ground enough, and is of a rich full bodied brown, ready for galling or shumacking:—shumac being the substitute for galls, and termed macing. Lot 2 is not full enough, and must pass through logwood, then copperas, and then be washed off. Lot 3 is still more deficient; this must be passed through logwood and then copperas twice, and then washed off, and lot 2 and 3 dried again.

Then lot 1 will be shumacked first time; that is, passed through a decoction of shumac, then through copperas, and then washed off, and if the decoction of shumac is kept up strong, after being all of them once shumacked they may be dried. Lot 2 and 3, when they are dry, are to be shumacked likewise, the same as lot 1, and dried.

As soon as any of them are dried, they are ready to begin upon again; or to shumac the second time, by passing them through a decoction as before; but instead of copperas, some of the alder bark and iron liquor are used, or as we shall term it, the liquor of the black vat. They are then washed off and dried. If the black liquor and the shumacking were powerful, some of them will shew themselves finished when dry. These are therefore taken out by the labourers of the drying mount, as it is termed in London, being a raised building for the purpose; or a stove. The foreman, as before, examines them; some he finds finished, some must go through the last process again. Such as are finished, and all as they are finished, are well and repeatedly washed off in fresh clear soft water two or three times, and then dried.

The cambrics are sent to be calendered, to imitate silk sarcenets. If they are book muslins they must be sent to the muslin dressers, except where, as in some cases, they sarcenet and dress their own goods.

By the above method the ground is secured, and so is the black, and likewise the strength of the goods.

An indigo ground for wool enriches the black dye; for silk and cotton it is not necessary.

Wool has a strong aud powerful affinity to *all* dying materials.

Silk has a strong affinity for galls, and advantage is taken of this; for silk being a valuable commodity, it is often galled to excess, merely to increase its weight.

Cotton has a strong affinity for iron, and iron has the same for galls or gallic acid wherever it may be found; therefore in shumac, in logwood, in alder bark, &c. iron will unite with gall and gall with iron, whenever they are connected by the medium of water.

Cotton Violet.

Pass the skein through the black vat, and dry it; then pass it through a decoction of galls, and dry it again; then through a decoction of logwood, then of alum and verdigris, washed off and dried.

For doing them by the black vat liquor, viz. the liquor of old iron and alder bark, in some cases. Let the vat liquor be prepared from the iron hoops, with vinegar, rye meal, or coarse bran, &c. before described. By this liquor it is easy to procure all the violet shades, from the pansy flower up to the lilac and violet.

The goods must be first blue vatted and dried, then galled and dried, then passed through the iron liquor, then maddered, then washed off and dried; the liquor always to be much under a boiling heat, as boiling heat browns madder; and what drugs are necessarily boiled must be prepared by a decoction of them being made beforehand.

For some shades blue vitriol is used, in some cases verdigris, saltpetre, and alum.

To dye to pattern, the decoctions should be always of one given strength, and all solutions of the bases or mordants the same. The time of working the goods in the dye, to be regulated by the fulness or lightness of the pattern, and the proportions of the various drugs, &c. used, much or little accordingly, reserving patterns of processes with particulars respecting the said process noted down; in proportion to the number of these upon record, and with strict attention to the subject, a good pattern dyer is formed; time and practice is required, and is absolutely necessary, with a delight in the business; for without a pleasure in dying no man can become an eminent dyer; labour and pains there are in abundance in many of its branches, and a portion, and not a small one, of pleasure, in other branches of it, to counterbalance the care, anxiety, labour, and fatigue, necessary within the whole scope of the art.

To dye Cotton Red.

If the cotton skein has not been cleansed since spun, it must be cleansed, by being boiled in a solution of potash: one ounce of potash to a pail of water may be enough, if the potash is good and strong, and in some instances more than enough. The cotton skein is put into bags when boiling, then washed off, and passed through clean water, scoured with a little oil of vitriol, and then washed off again; then galled, washed off, and dried. The galls should be white galls: for twenty pounds of cotton, five pounds of galls are boiled in about one hundred and twenty quarts of water (the galls pounded): it should boil for two hours.

After galling, the cotton must be alumed: four ounces of Roman alum for every pound of cotton. When alumed it must be washed off and dried.

Then the cotton is dyed in a copper of madder; six pounds and a quarter of best Dutch grape madder. The heat is kept under that of boiling, for three quarters of an hour afterwards in some cases. After being aired, washed, &c. it is put in, worked and boiled for twelve or fifteen minutes. Some say it is to be dyed again two days after; because the longer, to a certain degree, between aluming, dying, and drying, and between one dying and the other, the better. This second time of maddering, eight ounces of madder are used for every pound of cotton. Some dyers gall it twice, consequently dry it as often; then dye it at once in the madder, having a proportion accordingly. This red is a full bodied colour.

To dye a particular Red, termed Adrianople Red, or Turkey Red.

For one hundred pounds of cotton, unbleached in the grey, as it is termed.

To make Lixivium, No. 1.—One hundred and fifty pounds of Alicant soda, is dissolved in three hundred quarts of river water. There must be no more water than enough. An egg must float in it, or it will not be strong enough.

Lixivium, No. 2.—One hundred and fifty pounds of fresh wood ashes, and three hundred quarts of water.

Lixivium, No. 3.—Seventy-five pounds of quick lime, three hundred quarts of water.

The cotton is to be boiled in a fluid of equal proportion with the above three solutions, taken from them when clear, in a settled state. The cotton must boil three hours, and the liquor be replenished, so as to cover the cotton during the whole time: after this it is taken out, washed, and dried in the air.

A quantity of the above lixiviums, equal in proportion from No. 1, 2, and 3, of each, viz. one hundred and thirty quarts, may be equally mixed together, then this mixture is put by itself, viz. one hundred and thirty quarts; and into this is put twenty-five pounds of sheeps' dung, and part of the intestinal liquor: it being previously well diluted, by means of a wooden pestle, and the whole strained through a hair sieve. Then twelve pounds and a half of good olive oil is poured into this mixture, when finished it instantly forms a soapy liquor.

Into this liquor the cotton should be worked hank by hank, often stirring it; the cotton is then left in the liquor, after all the hanks have been worked separately first: they are to be left twelve hours. The cotton is then taken out, lightly wrung and dried. The liquor is put by for brightening; this is repeated three times during the working; and by the time the cotton is all worked, four hundred quarts may have been used, but that will not injure the clear of it from being applied in brightening; and it must be reserved for that purpose.

When the cotton has been three times dipped in this soapy water, and three times dyed, the same process is repeated, excepting that sheeps' dung is left out; the liquor is also preserved for brightening; the cotton having gone through these processes, it should be as white as if it had been bleached.

When dry, it is to be galled, using a quarter of a pound of galls to every pound of cotton: after galling it is dried; then six ounces of alum is to be taken for the first aluming; then it is to be dried again, and to hang three or four days in the air, and then when dry to be alumed again: four ounces of alum, and four ounces of the lixivium, may be added to the last alum water.

The madder used for this red, is called lizary, and furnishes a dye incomparably finer than that produced by the best Zealand madder.

Of this lizary (madder) in powder, take two pounds for every pound of cotton, and twenty pounds of liquid sheeps' blood, well struck into the water of the copper before the madder is put in; the butcher should stir the blood to prevent it from clotting; the copper should be carefully skimmed; the madder should not boil, but be carried during the process from blood heat to within a few degrees of the boiling point; if it boils at last, as some prefer it, it should only be for a few minutes.

In order to brighten the colour, the cotton is dipped in a lixivium of fresh wood ashes, and five pounds of soap, either the best Marseilles soap, or what in London is called the best white curd soap, or white Windsor soap; because either mottled or yellow soap would be improper. When the cotton has been well worked in this solution of soap and wood ashes, it is with the liquor of soap, &c. put into a copper sufficiently large to hold it, with some addition of water, to make it boil and keep up evaporation over a slow fire, for three, four, or more hours. The liquor must be covered with porous and coarse white linen cloths, to keep as much steam in as possible.

Some of the skeins of cotton are taken out from time to time and washed perfectly; when the red is judged perfect and sufficiently bright, the fire is withdrawn.

If instead of the wood ash, lixivium, and soap, the two reserved liquors and soap are used; the red would be much brighter than the finest Adrianople carnation.

CHAP. VII.

To Dye Skein Cotton Yellow.

The same operations as those in the first, common red dye are to be used here; to one pound of cotton, a quarter of a pound of Roman alum, and from one to four pounds of weld.

When dyed, the cotton is to be worked in a hot liquor of blue vitriol, but not boiling; in the proportion of a quarter of a pound of blue vitriol, to one pound of cotton: then it is to be boiled in a solution of soap, a quarter of a pound of soap to a pound of cotton. It should boil for three hours.

When a dark or jonquil colour is wanting, no alum is used; of weld take two pounds and a half, to one pound of cotton, with a quarter of a pound of verdigris; use half a pint of the lixivium.

For lemon yellow, for every pound of cotton, take one pound of weld, very little verdigris, or a little alum in its stead, but nothing else; though for brightening, boiling in a solution of soap, is always necessary in all cases.

On Dying Cotton Skein, Ducks' Wing Green and Olive.

This is performed by a blue ground, next galling, dipping in the black vat, then in the weld dye, then in verdigris;—remembering to wash off previous to each process.

Olive is to be done by weld or old fustic, verdigris, and Brazil wood.

Of Browns, Maroons, Coffee Colours, &c.

It would answer no purpose to enlarge this treatise with a needless detail of all the possible methods of procuring the various shades of these several colours, the whole consisting in the use of galls, verdigris, blue vitriol, weld, and madder.

By welding a stuff previously maddered for red, you may produce a gold colour; and by dipping the same red in a blue vat, a plum colour.

On Dying Silk Crimson, Scarlet, Yellows, &c.

According to Macquer, silk as it is taken from the pods, is gummed by a kind of natural varnish, which makes it stiff and hard. In the south of France it is of an orange colour, generally very dark; this stiffness is improper in the fabrication of most silk stuff, and its natural shade unfavourable to almost all other colours.

The skeins of silk intended for the greatest degree of white, those for example, intended to remain white, or for the fabrication of white stuffs, are boiled twice in soap and water; those that are to be dyed of different colours are boiled but once, and with a smaller quantity of soap, because the little remaining redness is by no means prejudicial to many colours; different quantities of soap are necessary for various colours.

Ungumming and Boiling Silk, to produce the greatest Degree of Whiteness.

The silk is divided into hanks, each hank is tied with a string, several of these are tied together, a handful of them, by putting a piece of string through each separate skein, and tying this piece of string in a long tye to slip easily when they are wanted to be untied.

A liquor is prepared of thirty pounds of soap, to a hundred pounds of silk; the soap is cut into small pieces, and boiled in water; the soap should be white curd, or Windsor soap; when this is dissolved by boiling, the fire is damped.

Whilst the liquor is preparing, the skeins of silk are passed on to rods; when the soap liquor become less than boiling hot after the fire is damped, for it should not boil, as that would fuz or tangle the silk. Then the silk is put into the soap liquor, in an oblong copper, being nearly full; here it remains till its gluten has left it, which is perceived by its whiteness and flexibility. It is then turned end for end on the rods, that the part above the liquor may undergo the same operation, and as this is accomplished, the silks are taken out of the copper, the hanks that were first turned being always the soonest done.

The hanks are then taken from the sticks to the peg, disentangled, and nine or ten of them put on one cord; this cord passing through the string that tied each hank. When the whole is corded, it is put into pockets of coarse strong white linen, fifteen inches wide, and five feet long, closed at each end and on one side; when the silk is put in, the pocket is sewed all along the other side with packthread, and fastened with a knot; four pockets will hold the whole hundred weight.

The pockets being ready, another liquor is prepared like the first: a soap liquor of thirty pounds; when ready, and the boiling checked with cold water, the pockets are put in, and boiled hard for a quarter of an hour, checking with cold water; in order to prevent its boiling over, it is necessary to turn the bags about often with a pole, or rather let two men have a pole each for that purpose. This operation is called boiling.

In the boiling of silks for common colours, twenty pounds of soap will do for a hundred weight of silk; but as in this case the silk is not ungummed, it should boil for three hours and a half, making good the evaporation.

Silk designed for blue, iron grey, brimstone, or any other colour requiring a very white ground; should be done according to the preceding process, and have thirty pounds of soap.

When the silk is boiled, it is taken out of the copper by two men with poles, who hoist the bags one after the other out of the copper, into a clean barrow. Then they are taken to a long shallow trough, from which the water may run away, and the pockets are unsewed by untying the knots and drawing out the packthread. The silks are then examined, and such as have yellow or lemon colour spots remaining, are boiled again for some time, till these spots are removed: after unpocketing, the whole is dressed on the pegs.

Silk loses from twenty-five to twenty-eight per hundred of its weight in ungumming and whitening. The bags of silk should never be suffered to lay long together before they are emptied after boiling, as this would make the silk hard.

White silk, as before observed, is distinguished into five principal shades, viz. China white, India white, thread or milk white, silver white, and azure white.

The three first are prepared and boiled, as I have already shewn. The silver and azure white require azure in the preparation or ungumming. Thus, take fine ground indigo, put it into water boiling hot, when settled, the clear is called azure.

To azure the silk, it is taken from the ungumming copper, after it is dressed, and put into a trough of water; after they are worked, drained, and again dressed, they are ready for the whitening.

Whitening.

To a copper holding thirty pails of water, half a pound of soap is added, when it boils and the soap is melted, you take the silk on rods; thus having them ready, prepare your copper as follows: for china white, you add a little annatto (prepared), the mode of preparing the annatto we will hereafter treat of. The silk being on rods is put into the copper, and kept turning end for end, without intermission, till the shade is uniform.

For Indian white a little azure is added, to give the blue shade.

For thread white and others, you add a little azure.

The liquor should be very hot, but not boiling; the turning five times repeated, by which time the shade is even. When finished, it is taken and wrung, and spread on poles, to dry, and, that part of it required for sulphuring must be put upon rods or slight poles.

Sulphuring.

The hanks being upon poles, seven or eight feet from the ground, in a room appropriate, one pound and a half to two pounds of roll brimstone will sulphur a hundred weight of silk. Put the brimstone into an earthen pipkin, with a little charcoal or small coal at bottom. When grossly pounded, it is put on the coal. You then light one of the bits with a candle, which will set fire to all the rest.

The room should be close; the chimney, if it has one, should be closed up likewise; the sulphur should burn under the silk all night.

The next morning the windows should be opened to let the smoke out and admit the air, which, in summer, will be sufficient to dry the silk: but in winter, the windows must be shut as soon as the sulphur smoke is dissipated; and a fire lighted in the stove or stoves, for the purpose of drying.

N. B. If the room for sulphuring does not admit of openings sufficient for the dissipation of the smoke, the work people will be in danger of suffocation.

When the sulphur is consumed, it leaves a black crust; the crust will light the future sulphur like spirit of wine.

If, in dressing, the silk sticks together, it is not yet sufficiently dry.

Silk that has been sulphured has a rustling with it which, for some things, is esteemed, but this would not do for silk to be watered. If the silk that has been sulphured is to be dyed, it must be unsulphured for many colours.

Silks for lace, gauze, &c. are neither boiled nor ungummed; those silks which are naturally the whitest, are the best for those articles. It is sufficient to dip the silks in warm water, and wring them; then sulphur them, afterwards azure them, again wring them, sulphur them a second time, or soak them in soap water; those for whitening, hot enough to bear the hand, adding azure if necessary, and turning and returning the silk in this liquor.

The fine silk of Nankin requires no whitening.

On aluming the Silk.

The silk should be turned and returned in the alum liquor, being first well washed and beetled, the hanks being tied loose for every thread to take alike, and worked cool in the alum, at intervals, from morning till night, afterwards taken out, beetled, and rinced. The above proportion of alum will do an hundred and fifty pounds of silk before you need replenish it; when this may be necessary, add twenty-five pounds more of alum, as at first directed, and so continue to replenish it, till it gets a bad smell. When this is the case, you may dip for browns, maroons, &c. And afterwards throw the liquor away; the trough is then to be rinced for a fresh liquor. Remember always to alum cold, or you will spoil the lustre of your silk.

CHAP. VIII.

Skein Silk, for Yellow.

This is to be boiled with about twenty pounds of soap for every hundred pounds of silk. When boiled it is to be washed and alumed, and then again washed, dressed and put on the rod, seven or eight ounces to a rod, and then dipped and returned in the yellow liquor, in the proportion of two pounds of weld to one pound of silk. The liquor is not to be hotter than you can bear your hand in it while the silk is in. The silk, when in the vessel, for dying, should cause the liquor to float within two inches of the edge. The silk must be taken out and the liquor strengthened, if the pattern is very full. When full enough, a preparation of pearl-ash, viz. one pound for every twenty pounds of silk, must be dissolved in some warm water; about a quarter of this alkaline liquor is put into the dye bath: take the silk out while you put in the pearl-ash liquor, and stir it well. You then put the silk in and work it, turning and returning as at first. After seven or eight returns, one of the hanks is to be taken out, and wrung, and tryed at the peg, and if sufficiently full and bright, all is well: if not enough so, more pearl-ash liquor must be added, and worked as before, till the shade required is accomplished.

For jonquil, it may be necessary to add some annatto when you put in the pearl-ash.

For the light shades, such as canary or lemon, to make them perfectly white, they must be boiled with thirty pounds of soap to a hundred pounds of silk, and if these are not azured, to dye them, they must have a little of the blue vat and a little of the weld liquor in water, so as the whole mixture shall be as hot and no hotter than the hand can bear, well mixed, the silks ready on the rods, quickly worked through and out. For deeper lemons, the same process must be used as for the fuller yellows, only less weld in proportion, and twenty pounds of soap will do for a hundred pounds of silk in whitening of it. The blue of the vat is only used for such articles as are to have a green cast, and that extremely light, and the aluming should be in a weaker alum liquor; and for light lemons, prepared in a separate liquor.

Preparation of Annatto—for Aurora, Orange, Moidore, Gold Colour, and Chamois.

You must have a cullender in proportion, as for size, to that of the copper in which you boil the annatto. For every pound of annatto there should be from twelve ounces to one pound of pearl-ash added: first, dissolve it in water, and add the solution by degrees, as the annatto boils and melts; to which purpose, you have the annatto in the cullender suspended over the copper by a flat stick about six inches broad, run through a flat handle each side the cullender, by which means the cullender is kept sunk in the water with the annatto in it, till it is all dissolved, excepting some little that may be foreign to it, and waste: the holes in the cullender should be moderately small.

Dissolved in this manner, the annatto, if preserved clean, will keep as long as you please.

Silks for the Aurora or Orange.

These require but twenty pounds of soap for boiling white.

To dye aurora, the silks must be prepared the same as for yellow. Annatto, thus prepared and settled, is then put into a copper of hot water, in quantity according to the shade required;

having mixed it well, the heat as hot as you can possibly bear your hand in it, you must return the silk in this liquor: when even, one hank is tried, as in the yellow, if it is not full enough, the liquor must be strengthened till the pattern is equalled. When finished, the whole is washed twice and beetled. The aurora serves as a ground for moidore.

To dye Moidore.

As fustic and logwood are to form component parts of this dye upon the annatto ground, the silk must be alumed, then washed from the alum, in order that the superflux may not make the dye uneven: a fresh liquor is then prepared, rather hot, to which must be added a little of the decoction of logwood, and of the decoction of young fustic. The silk is returned in this liquor, but if apparently too red, you may put in a very little of solution of copperas, which will make it sufficiently yellow.

When silk is dyed with the gum, in the raw, the annatto must be used nearly cold, or the elasticity of the silk will be destroyed.

Process for Orange.

After dying aurora with annatto, it is necessary to redden the annatto ground with vinegar, alum or lemon juice.

For the brightest oranges, and up to the degree of scarlet, poppy, &c. the silk should have an annatto ground, three or four shades under that of aurora. There is no occasion for alum when the silk has been grounded and washed off. If for orange, a liquor that has been used for poppy, will be sufficiently strong to finish it, or for light cherry, rose, &c. For flesh, the lightest of these colours is so delicate that a little of the soap water used for boiling, should be added to the liquor, to prevent the silk from taking the colour too quickly, or uneven.

Liquors having safflower, or weld, as part of their compositions require to be immediately worked, as, by keeping, they lose their colour, that is the safflower and its compounds, and are entirely spoiled. They are always used cold, because the safflower cannot stand heat.

The safflower preparation has been before described, where the process of cotton pink is performed by its solution.

To dye Silk Poppy.

When the silk has received the annatto ground, three shades less than for aurora, the safflower preparation must be ready, and turned by the solution of tartar, as before described, and the silk well washed from the annatto ground, that the alkali of the pearl-ash, used with the annatto, may not counteract the tartar of the safflower, a bath of this safflower must be thus prepared for the silk as strong as can be. The silk is then worked six or seven times through it, and for a full poppy, it is necessary to pass the silk through four or five such liquors. The poppy is the deepest colour that can be done with the safflower. I have observed before that the liquors left from the poppy, if used directly, will serve for the orange, cherry, flesh, &c.

Archil, as described for crimson, with cochineal, for wool, as before directed, is to be used upon some occasions: in other cases, some patterns have no ground of annatto.

A cheaper Poppy, by Annatto and Brazil Wood.

The silk is to be grounded with annatto as before; when well washed off, it must be alumed, then washed off again; then passed through the decoction of Brazil wood—washed off, again passed through a fresh decoction of Brazil wood, and every time that goods are passed through the dye, as I have said before, they must be worked end for end of the skeins from five to seven times, to have them even, and to give them the moderate degree which they should possess, and to extract the dye from the fluid by the affinity of the mordant used, or of the resinous body of the dye to the correspondent quality in the silk. These repetitions must be made in proportion to the pattern; with the Brazil decoction it is necessary to add a little soap liquor, about five quarts to thirty pounds of silk, well mixed. This keeps the alum used to receive the Brazil decoction from having a stiffness, and on the contrary, preserves it soft and pliant.

The above poppy serves for a ground for brown red colours, by the addition of logwood. A decoction of logwood, Brazil wood, old fustic, &c. as I have before observed, should always be ready boiled.

On dying Silk fine Crimson.

Silk intended for the crimson of cochineal, should have only twenty pounds of soap to one hundred pounds of silk, and no azure, because the natural yellow of the silk which remains is favourable to the colour intended.

The silk is to be strongly alumed, and left in the alum from seven to eight hours, then washed, and twice beetled at the river. (Remember how the alum is to be worked as to the manual part.)

While this is doing, a liquor is to be got ready of nut-galls, and Aleppo white galls, from one to two ounces to each pound of silk, well pounded and sifted; and of cochineal, fine, pure, well ground and sifted, from two to three ounces for every pound of silk: these drugs are to be put into water, clear, soft, and pure, in a pure tin boiler (made of grain tin, not what is commonly called tin, which is iron covered over with tin, and would utterly spoil the dye). Neither copper nor brass would be so favourable as pure grain tin. The same I observed when treating upon scarlet in grain, in woollen cloth, or worsted. This is strictly observed by all the dyers for the East India Company. When the cochineal and galls have boiled, you add to the liquor, for every pound of cochineal, about an ounce of solution of tin; it is called composition, and is made in the following manner:

Composition for Silk Dye of Scarlet with Cochineal.

1 lb. of spirit of nitre.
2 oz. of sal ammoniac.

6 oz. of fine tin, in grains, or prepared as stated for the scarlet for wool.

12 oz. of water.

The sal ammoniac, the prepared tin, and the water, are put into a stone jar, then the spirit of nitre is added, and the whole left to dissolve.

This composition contains much more tin and sal ammoniac than is used for the scarlet of cochineal upon wool; it is, however, absolutely necessary.

The proportion of this composition, that is, an ounce to a pound of silk, is added to the galls and cochineal when boiling. The boiler is then cooled down a little, the fire-door thrown open, the silk is put in, and worked from five to seven times, by which time the silk will have become pretty even, so far as it has taken. The door is then to be shut, and the copper is again brought to the boil; it should continue boiling, and the silk kept turning for two hours; the fire is then taken from under the copper, and the silk is immersed entirely, and left all night, or for seven or eight hours at least. By that means, it takes a full half shade; it is washed the next morning, beetled twice, wrung as usual, and put on the pearches or poles to dry.—*Macquer.*

The least tincture of copperas in the water saddens the crimsons, takes off their yellow, and gives the violet cast; but if too much of the yellow is carried off, it may be restored by fustic. Nothing but copperas will sadden grain scarlets, the logwood being quite useless for this purpose. Copperas alone will suffice, as it darkens greatly with the nut-galls.—*Macquer*.

Another Process.

When the silk is boiling in the soap-liquor, add an ounce of annatto for every pound of silk, working it through the cullender the same as before directed, but without the composition or tartar; yet, in some shades, both composition and tartar are admitted. The solution applied to cochineal with worsted, has a considerable effect, changing it from a crimson, its natural colour, to a prodigious bright fire colour; but produces only a crimson when applied to silk: but it gives this colour a very beautiful tint, for, uniting with the tartar, it increases the effect without impoverishing the colour, and saving the annatto ground.—*Macquer*.

Crimson by Brazil Wood.

The silk should be alumed, then passed through a strong decoction of Brazil wood, half a pail to a pound of silk is to be added, the silk is to be worked, and put through an additional and strengthened dye of Brazil if required, and washed off; and if in hard water, the water will generally crimson the Brazil wood sufficiently; but if soft water, a little pearl-ash must be added, about one pound of the clear solution of pearl-ash, or rather, the clear solution of a pound of pearl-ash, as one pound of water will not, I believe, dissolve a pound of pearl-ash: this is enough for forty pounds of silk.

The solution of Brazil wood is prepared thus: about a hundred and fifty pounds of Brazil wood chips are to be put into a copper, containing about sixty buckets; the copper is then filled, and boiled for three hours, supplying the waste of evaporation; the fire is then damped, the clear liquor drawn off, the copper filled again, the door shut, and the copper then again boiled for three hours more. This is repeated four times in all, from first to last, when the dye of the wood is fully extracted. Logwood and fustic, that is, old fustic, is done in the same manner; only half the number of boilings required for the Brazil will do for them.

Of Fine Violet.

For this colour, the common boiling is used, the silk is alumed the same as for fine scarlet, washed, and twice beetled. The silk thus prepared, two ounces of cochineal is given it, with the same precaution as usual, but no composition, nor tartar. Being worked but moderately warm, in working it must be turned with expedition; after about a quarter of an hour, the liquor should be brought to a boil, and then the turning need not be so expeditious, though it should continue two hours. After being washed, the silk is dipped in the vat, more or less strong according to the shade required. Washing and drying are done in the same manner as for blues and greens, and, in general, for all colours dipped in the vat, viz. a small quantity at a time, in order that the silk may be kept open to the air, and that the greening of the vat may pass correctly and equally to blue, without any unevenness. For some shades, archil forms a component part of the dye.—*Macquer.*

Observations on Crimson upon Silk.

Crimson upon silk is produced at Norwich, in London, and at sundry other places, by means of a much greater quantity of cochineal than the proportion which Macquer mentions, for in some cases as much as a guinea a pound has been paid for silk to be dyed crimson at Norwich (as I have been well informed). Archil has been used likewise in crimson, and the time of boiling is not so long. In some shades a little of the composition and tartar may be admitted, but in a small degree. The scarlet upon silk is mostly done by annatto and safflower.

On dying Silk Green.

This colour is composed of blue and yellow; it is with difficulty produced on silk, because the blue vat is liable to spot, and give a party colour, an inconvenience more liable to green than blue, and more perceptible. The boiling of the silk for greens is the same as for common colours.

We shall distinguish the principal shades.

The silk being alumed as usual rather strongly; washed off, and divided on the sticks into small hanks of about four or five ounces, that it may be the more equally and easily divided in the working, from the yellow to green, in the bluing, from the blue vat.

Weld is then boiled, as stated in the article upon yellow; when boiled, a liquor of it is prepared strong enough to give a lemon ground; the silk is then turned with all the expedition, care, and precaution above mentioned, that it may be even. When it seems full enough, some of the threads are separated, and dipped in the vat, to ascertain if they are full enough; some more weld liquor must be added to the dye bath, and the silk returned and tried again, and so on; and when the colour comes right, the silk is washed off and beetled. It is then wrung and formed into hanks, for dipping into the vat, being dipped skein by skein, the same as the blue, and as the purple should be, it is wrung with equal care and despatch. The above green is a species of the sea-green, of which there are upwards of twenty shades. The lighter shades, when taken out of the vat, are not washed, but worked in the hands by clapping it between then, and carefully opening and airing it; by which means the silk being opened, disentangled, and aired, the colour becomes equally clear. A few threads are then washed, or rinced, and if the colour be right, then the whole is washed.

For the dark shades, when the weld is exhausted, a little logwood is added to the liquor, in some cases old fustic, and in some, annatto.

For very dark duck wing or bottle green shades, a little copperas may be added.

Of Olives.

As to aluming, &c. you are to proceed in the same way as with the other colours; the weld liquor being stronger, some logwood is added; when the weld and logwood are exhausted, a very small quantity of them is to be added, which greens the liquor, and the silk is passed through, and a greenish olive is produced. When a reddish olive is required, fustic is used instead of logwood and pearl-ash, both of these being omitted.

Olive would be too green with the vat, for logwood violet, turns blue with the pearl-ash, which combining with the yellow of the weld, gives the green of this shade.

Fustic gives a colour commonly called drab-olive, upon cloth, because generally made to match with olive, and this is commonly redder than the preceding.

On dying Silk grey; of Nut-greys, Thorn-greys, Black and Iron greys, and others of the same Hue.

All these colours, black grey excepted, are produced without aluming. The silk being washed from the soap, and drained on the peg, a liquor is made of fustic, archil, logwood, and copperas. Fustic gives the ground, archil the red, logwood darkens, and the copperas softens all these colours, turns them grey, and, at the same time, serves instead of alum, in extracting these several colours. As there are an infinite variety of greys, without any positive names, and produced by the same methods, it would be endless to enter into details that would prolong this treatise to so little purpose.

For reddish grey the archil should predominate, for those more grey, the logwood, and for those rather greenish, the fustic.

Care should be taken not to use the logwood too much, as, with the copperas, it darkens more than most drugs: therefore the black vat made with either alder bark, or the other preparation mentioned in dying cotton, would be preferable to copperas.

Nut-Grey.

The fustic decoction, archil, and a little logwood, is put into water moderately hot, the silk is then returned, and when the liquor is then exhausted, the silk is taken out, and, to soften the colour, the solution of copperas or black vat, is added. The silk is then returned once more, and if the colour does not appear sufficiently even, some red spots still remaining, it may be concluded that it requires a little more of the copperas.

It must be also remembered, that, as copperas is the general base of all greys, if deficient in quantity, the colour will be apt to change in drying, and to become rough and uneven.

To try if the colour be sufficiently softened, it should be examined, and if it wets easily, after having been wrung on the peg, it wants copperas. But, on the contrary, if it soaks with a little difficulty, the colour is softened sufficiently.

On the other hand, too much copperas stiffens the silk considerably, making it harsh, and even depriving it of a great part of its lustre, to remedy which, it must be extra-washed, and wrung at the peg, which carries off the copperas.

The Black-greys.

These are alumed and welded, as for yellow, and when the liquor is exhausted, part of it is thrown away, and some logwood added; when the logwood is exhausted, copperas is added sufficient to blacken the colour, the silk is then washed, wrung, and finished as usual.

Iron-grey.

For iron grey, it is necessary to boil the same as for blues; this colour is much more beautiful, when laid on a very white ground.

By having the drugs made into decoctions, before hand, greys, either in woollen, silk, or cotton, may be dyed at a heat, not much above what the hand will bear, and in a rotation of shades from light to dark, and varied, blue, red, yellow, brown, &c. with ease, and with pleasure, so may likewise many stone drabs, and other light brown drabs, as the mixture of yellow, fawn, and black, produce nut browns, &c.

APPENDIX.

When I commenced the present treatise, I wished to impress every reader desirous of understanding the art and mystery of Dying in all its branches, with the idea that, if he did not know the portion of modern chemistry necessary to lead him to the secrets of dying, and especially his own particular branch, he would labour, like many of our predecessors, under very great disadvantages. If our theory is not true, we work from a wrong data; it may approach the truth; it may be right in some things, and wrong in others; our uncertainty and mistakes will be accordingly.

I mentioned how necessary it was to mark the difference, in the constituent parts of the vegetable and animal bodies upon which we have to act when we are operating in dying, and we have seen what difficulty there is in dying cotton any thing of a red, like cochineal scarlet, or crimson on wool. We have seen, that in dying cotton yarn the Adrianople red, how the intestinal liquor of the sheep, the dung, and the blood, of the same animal are used, and have been found beneficial by the dyers of Asia, which red is termed the Adrianople or Turkey red. It is found by experience, and particularly in hot climates, that substances containing volatile alkali quite developed, have the property of raising and exalting the red colours. It has been found that the tenacious gluten of the bones of animals have the faculty of retaining the colour of madder very strongly, as has been proved by hogs who have eaten madder; and the vivacity of the colour in those cases has been attributed justly to their volatile alkali; and chemical vessels used for extracting volatile alkali, also retain for a long time the smell of the same, even after being washed and scrubbed with sand, soap, &c.

The dyer makes use of many mineral substances, such as sulphate of iron, vulgarly called copperas, sulphate of copper, commonly called blue vitriol, alum, &c. some definition of which I gave at the commencement of this work. For further particulars I there did, and do still, recommend the dyer wanting information, to the elementary works of Parks, Parkinson, and several other authors on chemistry, which may be had of

Messrs. Sherwood, Neely, and Jones, Paternoster-row.

Among vegetables there are three, the nature and properties of which it is very essential, for the dyer to understand well, because, for want of the knowledge of one of them, in particular, losses are often sustained to a very serious amount. For want of this knowledge, even to this day, I have not seen in any author on dying, or chemistry, any just theory of the pastil, or woad vat, relative to its working, so that the dyer might derive certain just rules how to use the dye from the woad, upon his materials, and renew and work it down afresh again, and again, with an assurance of never letting it be decomposed, and spoiled, through inexperience, which, for want of a true theory, has very often been the case. We will endeavour to lay down the sure theory, with a view to escape those fatal and expensive disasters.

The mineral bodies, as far as they have been examined, have no life or peculiar organization, excepting that which results from the attraction of their particles: but let us proceed to the chemical consideration of those substances which possess such an organization, and irritability, as enable them to fulfil the two great ends destined by nature; the continuation of their own existence, and the reproduction of their species.

Though at first sight, it may appear easy to distinguish the three kingdoms of nature from each other, yet there is such a gradation, such an imperceptible transition of one kingdom into another, that it is difficult to give a characteristic definition of one which embraces all the individuals of it, and, at the same time, excludes all those of the other kingdom. Indeed, on inquiry, we shall find that there is no natural distinction of this kind, and that there is not a function, common to vegetables and minerals, which some of the animal tribe do not enjoy, and vice versa.

The substances, constituting the texture of vegetables, differ from mineral bodies, in being of a more complex kind; and, though vegetables are extremely susceptible of decomposition, by analysis, not one can be synthetically produced.

Though vegetables, by their analysis, shew that they are composed of four or five simple substances, viz. caloric, light, water, air, and carbon, yet nothing, but the texture, and organs of living vegetables, can, from these substances, form the matter from which they are extracted.

Though vegetable bodies are composed of these few simple principles, yet we find a great variety of substances produced by their combinations;

these may be reduced to a certain number of principal heads, which, with Fourcroy, we shall call the immediate materials of plants, because they are obtained from them by simple processes, almost wholly mechanical, and by a kind of direct analysis, which does not alter the nature of the products.

Among these immediate materials of vegetable bodies, are the following substances, either fluid, or solid. Extractive matter, mucus or mucilage, sugar, essential salts, fixed oil, volatile oil, aroma, camphor, resin, balsam, gum-resin, fecula, gluten—colouring matter, elastic gum, and woody fibre. Of these immediate materials, which are formed of some or all of the simple substances before mentioned, all known vegetables are composed. The properties of each of these materials, are particularly pointed out in the elementary books of chemistry.

Since these immediate materials are all composed of, and capable of being separated by analysis, chiefly into carbon and water, it may be proper to inquire how vegetables acquire the principles which form these materials.

Water is evidently the source whence vegetables derive the hydrogene; this fluid is decomposed in their glands, assisted by solar light, and becomes fixed in them, in the state of oil, extract, mucilage, &c. The greatest part of the vegetable, however consists of carbon, which it obtains from the decomposition of the carbonic acid floating in the atmosphere, or dissolved in the water, which is absorbed when these vegetables decay; their mould affords carbon to future vegetables, which nourish them luxuriantly. This mould, or carbon, is however gradually exhausted by vegetation, when the crop is carried off, and then the farmer is obliged to supply fresh quantities of carbon, which is generally done in the form of dung: the rain water which falls on the ground thus manured, becomes saturated with carbon, and then contains all the principles of vegetation.

Animal substances differ from vegetable, principally in the following circumstances. First, they afford a considerable portion of ammoniac, and very fœtid products by the action of fire. Secondly, they putrify more easily and speedily, giving out a much worse smell. Thirdly, they yield, when acted on by nitrous acid, a much greater quantity of azotic gaz; and, lastly, contribute singularly to the formation of nitric acid.

These differences seem to depend upon animal bodies being possessed of one substance in a much greater abundance than vegetables, viz. azote. Besides these circumstances, in which animal substances differ from vegetable, the former generally contain a quantity of phosphoric acid, and calcareous earth.

Azote, which is so abundant in animal substances, is undoubtedly the cause of their concrescibility and plasticity. If we should deprive animal substances of their azote, they would be converted into substances resembling vegetables, and if we could introduce azote into vegetable substances, we should animalize them.

All matter which forms the bodies of animals, and which may be extracted from them, without altering their nature, may be considered as so many immediate principles, as we have shewed with respect to vegetables.

The principal animal fluids are; first, the blood, which consists of three immediate materials, or principles, the serum, the crassamentum, or coagulable part, and the colouring part, or red globules, as they are called. Secondly, milk, which is the least animalized of all the fluids, and consists likewise of three materials, serum or whey, butter and cheese. Thirdly the bile, which is a saponaceous fluid, consisting chiefly of an animal oil combined with soda. Fat is nothing but animal oil in a coagulated state.

The substances which compose the solid parts of animals, may likewise be divided into three immediate materials, or principal genera; first, albumen, second, gelatine, third, fibrine, or fibrous matter. These three substances, in a state of concretion and combination, form all the solids of animals, and are separable from each other by an easy analysis. The different immediate principles are particularly set forth, as was stated before, in the elementary books of chemistry.

By whatever means we deprive animal substances of their azote, we reduce them to substances resembling vegetables. The muscular fibre excluded from the contact of air, but particularly if in contact with water, parts with its azote, and is converted into a substance resembling spermaceti, which, in its analysis, agrees with the common expressed oil of vegetables.

When vegetables and animals are deprived of life, movements are excited in them which destroy their texture, and alter their composition. These movements constitute the different kinds of fermentation.

When the saccharine principle is predominant in vegetables, the product of fermentation is a spirituous or vinous liquor; when mucilage is predominant, the product is an acid, and if the gluten should be most abundant, the fermentation will be of the putrefactive kind. Hence it is evident that vegetable substances may successively experience all the different kinds of fermentation.

When vegetable substances, particularly saccharine matters, are mixed in a proper quantity with water, and exposed to a gentle heat, the water becomes decomposed; its oxygen combines with the carbon of the vegetable, forming carbonic acid, which is disengaged, in large quantity, during the fermentation; at the same time, the hydrogen of the water uniting with the mucilage, form alkahol, which being mixed with water, and part of the carbon of the saccharine matter, together with extractive and colouring matter, is called wine.

The alkahol may be separated from these matters by distillation with a gentle heat.

Pure alkahol appears to be hydrogen in a liquid state, combined with a small quantity of carbon, which, most probably, causes its fluidity. For we find that the more we deprive it of its carbon, the nearer it approaches its state of hydrogen gas. Ether, seems to be hydrogen, combined with much less carbon; it is convertible into gas, with a gentle heat, which very much resembles hydrogen gas in its properties.

The acid fermentation is the next natural movement which contributes to reduce vegetable compounds to more simple states of composition.

After vegetables have passed through this state, their decomposition continuing under favourable circumstances, leads to the decomposition of the last principle, the gluten, which terminates in volatilizing most of their principles, in the form of gas. After this, nothing remains but a brown, or black residuum, called mould, composed of carbon, some salts, a little oil, and extractive matter.

When animal substances, deprived of life, are exposed to the air, their component parts soon become altered, by more simple attractions between their principles, which have a tendency to unite two and two together. In the union of hydrogen and azote, we perceive the formation of ammoniac. The combination of carbon with oxygen, explains the evolution of carbonic acid. Nitric acid arises from the union of oxygen and azote. A quantity of hydrogen is extricated in the form of gas, carrying off, with it, sulphur and phosphorus, which causes the disagreeable smell that attends animal putrefaction: nothing now remains but a portion of carbon mixed with phosphate of soda and phosphate of lime.

Hence we see that, by the processes of fermentation and putrefaction, complex bodies are converted into substances less compound; and that nature restores, in the new combinations that are formed, the principles that she had borrowed from the atmosphere, for the formation of animals and vegetables; and thus she accomplishes the perpetual circle of compositions and decompositions, which demonstrates her fecundity, while it announces equal grandeur and simplicity in her operations. *Garnett's Outlines.*

The reason of my introducing this appendix so far from Garnett, is with an intention to give my Theory of the Pastil or the Woad Vat.

In the pastil or woad it is admitted, I believe, that there is much volatile salt, in no respect differing from what is contained in many other plants. The indigo of South America contains it much more than any indigo, except that of Japan. In making the indigo, in South America, they find it very difficult to prevent putrefaction: in the East Indies it is fermented in four days, but in South America, it is completed in forty hours, and owing to the volatile alkali, the process often fails, and putrefaction takes place.—See *D'Apligny.*

Plants producing much fixed alkali, afford, in most instances, a large quantity of volatile alkali. We have seen likewise, that vegetables possess volatile oil and aroma; likewise gluten, so that, in the state of fermentation, to which it appears that the woad and indigo are obliged to be subjected, it is no wonder that, without a regular and true theory, putrefaction should take place in so many instances.

In the pastil, or woad balls, the feculæ are separated from the juice of the plant by an incipient fermentation, which was not continued long enough to separate from the feculence, the oil, and volatile alkali; so that these principles are confounded with the cadaverous part of the plant.—*D'Apligny.*

(The pastil and the woad, under the same cultivation, may be treated like the pastil, as to manufacture.) The pastil leaves are about one foot long and six inches broad. At Albigeoise, in France, they begin to ripen near Midsummer; when ripe, they bend downwards, and turn yellow; they are then cut, &c. They are cut a second time in July, and again at the end of August and September, and after All Saints Day are again cut for the last time: this interval being longer, the pastil has more strength than the others.

At each crop the leaves are immediately conveyed to the mill, and ground to a fine paste; this should be done immediately, because the leaves, when heaped together, soon ferment and rot, with an insupportable stench.—Vide *M. Astruc.*

Mons. Hellot quoted M. Astruc to the above effect, and agrees with Mr. D'Apligny as to the liability of woad becoming putrid, when he says, it smells like rotten eggs, as has been observed upon the woad vat. The consequence of a woad vat being lost, is serious to dyers in a large business, as well as to a small concern; because of the quantity of indigo in it, as well as woad, which is, at its lowest price, an expensive article.

The woad vat being worked by heat, and no otherwise, the old method of heating it, made the vat more liable to be lost than if it had longer remained cold, or was worked perpetually, as it is now in London, being heated with steam. There cannot now be the danger as there was in cessation, at uncertain times, and in uncertain states of the vat, as to richness or poorness of woad and indigo. We will suppose there is a dyer in the country, whose business is barely sufficient to keep a vat going: he does a small batch of work on Monday, but has not half worked it down, and has no prospect for two or three days of any more work; he may, possibly, try to keep it with lime, for a day or two; he may do so, and in the issue, in some instances, too much lime is the consequence. These things have been treated of before. I consider the danger none, with care and attention, when the vat can be kept at work daily, and replenished as it is worked down, as is the case in London, where, I believe, an accident seldom happens.

My reason for thinking so is this; the woad is always cut before it comes to form its flower quite perfect, if, in many instances, it is formed at all, which I doubt. We have seen, and know, that aroma exists, by its fragrance, in many blooming vegetables, and in its nature and properties, comes the nearest to an animal nature of any thing in the vegetable world; and I do consider that in the flower, blossom, and aroma of the plant, exists hydrogen, carbon and azote. If the plant is cut, as the woad is, during the process and before its complete ripening, all the principles above named, and the others essential to a perfect vegetable, is in the organization of the woad. If so, in a plant so nearly approaching animal nature, how necessary is chemical knowledge to understand the working of the vat. All the art of man, I am persuaded, could not always keep a vat, from the excess of either too much lime or too little, when heated but seldom, under a short course of work; for, when a vat is in order, it is like a vegetable, fit to gather; gather it, or it passes the time of its perfection; it may even be rotten ripe. Work the vat; withdraw from it, upon your cloth, its colour, which as soon as you expose it to the atmosphere, will combine with its oxygen, the oxygen with the carbon of the indigo and woad. If you play with it too long, the lime will raise its volatile alkali, some of the water may be decomposed; its hydrogen and sulphur formed by other decompositions, will form sulphurated hydrogen gas. The smell of rotten eggs always proclaims this. No one should attempt to have a woad vat or vats, except he can keep them nearly always at work. When worked down in a moderate time, and replenished with lime, woad, indigo, &c. working out, and replenishing in, there can be no danger. On the other hand, in proportion as the vat is out of order, although recovered, it must always be with uncertain loss.

On the Theory of fast and fugitive Colours.

Hellot's theory of fast and fugitive colours, or the great and little dye, has been long exploded. According to his definition, the hard crystallized salts of alum and tartar in a mechanical manner wedged the dye in the pores of the stuff; those salts being such as water could not dissolve, M. Le Pileur D'Apligny, in his treatise on Dying Cotton Skein, says, "I could never conceive that salts, however hard, such as vitriolated or crude tartar, could maintain their stability in the pores of the stuff; however small the quantity soluble in water, it would be difficult to prevent washing from carrying off a great portion of the salt, and consequently, of the colour; and equally difficult to prevent it from being injured by the decomposition of those salts." He asserts further from Macquer, "That as soon as the earth of alum is moistened, it greedily imbibes all the oily, and consequently, colouring particles of the bodies in contact." "This property indicates, in this species of earth, a strong disposition to combine with the principle of inflammability, and to retain it most forcibly. The earth of alum, therefore, possesses the property of attracting the colouring particles." "Concerning the colouring particles of the good dye, and which require the stuff to be alumed, these particles fix to the earth of alum by the power of attraction, and, at the same time, the acid of the alum is softened, by its combination with the principles of these particles, this acid, having served merely as a vehicle for distributing equally into all the pores of the stuff, that earth which it held in a state of the greatest possible divisibility."—*M. D'Apligny.*

This is saying more than Hellot could in his theory, which preceded D'Apligny. Hellot laboured nearly through half his book to explain his theory, and the consequences arising from it; but even D'Apligny held the theory of Phlogiston, therefore he could not argue so clearly as, Bertholet, Bancroft, Henry, and their contemporaries. These chemists considered oxygen as a certain principle, and looked upon phlogiston as an uncertain one; all that has been attributed to phlogiston, answering to oxygen. The latter therefore explained it more clearly, and in much shorter detail.

Vide Henry's Chemistry, and Bertholet on Dying, 2 vols. Also BANCROFT, on the Philosophy of permanent Colours, may be consulted.

D'Apligny says, " The cause of attraction we do not know, but since the effect is certain, let us confine ourselves to that consideration, regardless of the cause."

But, as all the sciences are dependent upon each other, being linked, as it were, in a chain, it is necessary we should in some degree understand the connecting links.

Agriculturalists and agricultural chemists know that the earth of alum constitutes three eighths or more of a fruitful soil, and some vegetables, and those especially that contain most carbon, as galls, indigo, madder, &c. They contain likewise alumine, or the earth of alum, in their composition. Is it any wonder then, that the mother earth has an affinity for her own offspring, when affinities exist through all creation?

Iron being likewise a component part of many fruitful soils, and of many mineral waters, I believe it likewise to be a component part of all drugs used for browns, fawns, and blacks. We have seen what affinity cotton has for iron, in the dye of buff upon cotton, and I believe that iron, not only causes black, grey, and brown hues, but, with lime, forms a component part of the drugs themselves, which give the brown dye, &c. See KIRWAN, on Manures, on the component parts of soil, and of the component parts of certain grain, the produce of such soil.

To inform a dyer of what description his coppers, casks, vats, &c. should be, is not requisite. Such as are adapted to his particular branch, are and have been before his eyes, and without plates at least, would, in sundry particulars, not be clearly understood. If a dyer finds it his interest to undertake a branch of business in any of the various departments of dying, of which he has not had any previous experience, he had better engage a man who understands that branch; but, if he thinks he is competent to manage it himself, but is unacquainted with the best modern utensils appropriated to that particular branch, he had better get a dyer's labourer, used to that branch, a man of sufficient intelligence may be found with due encouragement to perform this part.

All solutions and decoctions of Brazil wood, logwood, old fustic, &c. should always be prepared in the same quantity and proportion, and one measure be invariably set apart for each. I am now speaking of drugs in stock, always kept in a state of preparation, ready for any process of work that may occur. These drugs

I have named, may be kept in a prepared state, but weld boiled, will not, and others that will not, I have mentioned in the body of the work.

Weld, as it will not keep, should be used thus: a copper, in proportion to the work, should always be used, so that the size may, in some degree, always correspond, and as it will boil, and bear reboiling, you may boil it by the half bundle, if you are in the small way, termed in the trade street dyers, or rag dyers, or by the bundle, or more, according to your work, whether little or much. If you are thus exact, and near in your estimate, practice in work will soon make you perfect in any branch. I have observed before that to dye to pattern cannot be the result of a receipt, without a great latitude is left for the judgment. The most difficult part of dying is in dying light drabs, stone drabs, &c. Nothing but practice will qualify you for this, and all pattern dying; but the way, and the only way to gain practice is to work with all possible regularity. In dying fancy cloths, in the clothing counties of Yorkshire, Gloucestershire, and other fine cloth manufactories, the manufacturers that dye their own, and the dyers of the greatest eminence, always number, measure, weigh, and time, all the component parts of their various processes of dying.

Such should be the universal practice; and then a man of common abilities, as an arithmetician, may soon be able to perfect his processes in their results.

It would certainly, in the above case, be very necessary for the dyer to have a perfect knowledge of his drugs, that he may know the properties of the articles which he uses, and when they are, and are not genuine: to chemistry he must stand indebted for the abilities to render him capable of ascertaining this.

In possession of these qualifications, and working upon the above plan, the dyer can never be far from the desired result, in all his processes. The deviations, if any, will be few, as consequently perceiving the very first approach of any incorrectness, he will be able to adjust it in due time.

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